



इंजीनियरिंग प्रोजेक्ट्स (इंडिया) लि.

(भारत सरकार का उद्यम)

ENGINEERING PROJECTS (INDIA) LTD.

(A Government of India Enterprise)

TENDER DOCUMENT

NIT No.: DLI/C&E/WI-675/263

FOR

Tender for Design, Supply & Supervision of installation, testing and commissioning of 'AIR COMPRESSORS, RECEIVERS AND COOLING TOWERS' for the project of "Augmentation of Fuel and Flux crushing facilities (Package- 064) of Bhilai Steel Plant, (SAIL)".

VOLUME – 2B

TECHNICAL SPECIFICATION

ENGINEERING PROJECTS (INDIA) LIMITED

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GENERAL

The following Technical Specification shall be read in conjunction with General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification. If there are any provisions in this Technical Specification, which are at variance with the provisions of General Technical Specification (GTS) of Bhilai Steel Plant, SAIL and General Specification, the provisions in this Technical Specification shall take precedence.

1.0 DOCUMENTS/ INFORMATION TO BE FURNISHED ALONGWITH OFFER.

- (i) Clear Scope of supply.
- (ii) Type and quantity of oil, lubricants & consumables for initial fill till successful commissioning of equipment.
- (iii) List of Commissioning spares and start-up spares with unit rates.
- (iv) List with unit rates of special tools and tackles, if any required.
- (v) Price Schedule for supply work as per the format enclosed.
- (vi) List of recommended spare parts for 3 years trouble free operation and maintenance alongwith unit rates as per the format enclosed in price schedule.
- (vii) Technical Data sheets duly filled by the vendor (blank data sheets enclosed).
- (viii) Weight of the equipment in Kgs.
- (ix) Catalogues/ Leaflets and O&M Manuals.
- (x) Reference list of your Customers for the similar supply of items.
- (xi) Unpriced Copy

2.0 SCOPE OF SUPPLY

The scope of the work includes Design, Supply & Supervision of installation, testing and commissioning of '**AIR COMPRESSORS, RECEIVERS AND COOLING TOWERS**' as per specifications and scope defined in tender documents complete with all accessories and drive, which are not mentioned specifically but are required for the efficient and trouble free operation of the equipment/system.

2.1 Following items are also included in bidder's scope.

- (i) Complete items as per the details given in the specifications.
- (ii) Consumables like first fill of lubricating oils etc. for the initial operation of the equipment till handing over.
- (iii) Commissioning spares and start-up spare parts.
- (iv) Recommended spare parts for (3) three years trouble free operation and maintenance.
- (v) Painting of complete equipment (including final painting before handing over to the Employer).
- (vi) Supervision of Installation, testing & commissioning at site.
- (vii) All drawings/documents along with operation and maintenance manuals as per requirement mentioned elsewhere in the tender document.
- (viii) Getting approval of design/drawings and any other design calculation related to the equipment from BSP/MECON/EPI.
- (ix) Carrying out any modifications/deletions/additions/alteration in design/drawings/documents as required by client & Client's consultant and EPI for proper execution of works at site till completion and handing over of the project to the client.

2.2 Bidder to note the following:

- 1) BSP approved preferred make list shall be followed for Hydraulics & Pneumatics.
- 2) All HT and LT AC/DC motors, actuators, brakes etc. as per technological and process requirement.
- 3) Generally Squirrel Cage Induction Motor with DOL starter / Soft Starter will be provided. Use of Slip ring motor in general will be avoided. Suitable Rotor contactor panels and SS-grid Resistance Boxes will be provided for slip ring motors if inevitable.
- 4) Soft starter will be provided for LT motors of rating more than 75kW.
- 5) All LT motors for conveyors will be S6 duty and will have class F insulation with temperature rise limited to class B.

- 6) Equipment selection and dating will generally be based on ambient temperature of +50 Deg.C. For specific areas and shops, the ambient temperature conditions indicated above will be taken into consideration and equipment suitably derated wherever necessary.
- 7) The equipment should be suitable for smooth, efficient and trouble free service in the tropical humid climate prevailing at plant site and under the ambient temperature conditions indicated above for the different shops and areas. In hot areas of higher temperature conditions, the equipment will be adequately protected against damage from radiant heat and hot air.
- 8) Roller bearings will be provided at DE end for motor of rating 30KW and above.

3.0 Technical Specifications of Air Compressor, Receivers and Cooling Towers:-

The scope of work of Air Compressors, Receivers and Cooling Towers package includes;

3.1.0 Compressed Air Facility

3.1.1 Instruction to Contractor

3.1.2 Dedusting system of Coal Handling & Coke Sorting plant for COB #11 plant will require substantial quantity of compressed air. To meet the air requirement, a compressed air station along with interconnecting inter-shop and in-shop piping system upto the individual consumers will be provided in the Coal Handling & Coke Sorting plant area on turnkey basis.

3.1.3 The Contractor will furnish all the drawings, documents, data like fault diagnosis, operation and maintenance manuals, general details and layout drawings, design calculations and equipment specification of plant and equipment, together with 'as built' drawings for all mechanical, electrical, civil, structural and instrument & control.

3.1.4 Meteorological data

The following meteorological data will be taken into account for design of plant and equipment. Site conditions will be assumed to be as follows.

Temperature	:	48 ⁰ C (Max)
		9 ⁰ C (Min)
Humidity		
Maximum	:	100%
Minimum	:	25%
Altitude above MSL	:	307m

Design ambient condition for the compressors will be taken as 45°C temperature and 60% RH. Design ambient temperature for Electrics will be considered as 50°C.

3.1.5 Delivery Schedule

Delivery schedule will be matched with schedule of the overall package.

3.1.6 Scope of Work

The scope of the supply includes Design, Supply, Supervision, Packing, dispatch, transportation, delivery to site, installation, testing & commissioning completion of facilities, performance guarantee testing, and handing over to Bhilai Steel Plant, SAIL / EPI of **AIR COMPRESSORS, RECEIVERS AND COOLING TOWERS** as per specifications and scope defined in tender documents complete with all accessories and drive, which are not mentioned specifically but are required for the efficient and trouble free operation of the equipment/system.

The compressors will be housed inside a building (compressed air station). The Air receivers will be installed outside but adjacent to the building. The building and equipment foundations including grouting and chipping works, structural works, etc. are not covered under the scope of this specification. The compressed air station will comprise of the following main equipment:

A) AIR COMPRESSORS

- i) **Three (3) sets (2W + 1S) each of 36 Nm³/min (@ 8 kgf/cm²(g) discharge pressure after cooler) oil free, water cooled rotary screw packaged type air compressors with electric motor and all its accessories & auxiliaries including the following:**
 - a) Intercooler, after cooler, moisture separator with trap station,
 - b) Suction air filter cum silencer,
 - c) Lube oil system.
 - d) Cooling water system including duplex type filters in supply line.
 - e) Acoustic enclosure along with exhaust fan and necessary illumination.
 - f) Each Compressor will have dual type control system, which will permit operation of each compressor in either of the following way:
 - (a) Continuous Variable Load /unload regulation
 - (b) Automatic Start-Stop Regulation.
- ii) **2 no. Refrigerant type of Air Dryer's of Capacity 4 Nm³/min will be provided.**

- iii) Contractor has to furnish list of item wise spares for 2 years O&M along with unit rate. The item rates will be valid upto 12 months from last consignment at site
- iv) All anchor bolts & nuts, washers, foundation bolts, shear lugs, counter flanges for inlet and outlet of each compressor, receivers and connected piping & base frame for equipment. Miscellaneous materials and services, if not otherwise specifically mentioned will be included, but not limited to nuts, bolts, washers, gaskets, necessary connections for hook up with employer's pipe network and equipment.
- vi) List of spare parts for 2 years operation & maintenance.
- vii) Supply of first fill of lube oil & consumables and also for testing, commissioning and performance guarantee. Specification of all consumables will be indicated.
- viii) Commissioning spares (All spares used until the plant is handed over to the employer).

SPECIFICATIONS OF MOTOR SOFT STARTER

To avoid impact on electrical system due to heavy motor starting current, a soft start system limiting motor current to 2 to 2.5 times shall be provided to ensure voltage drop at motor terminals limited to 15% with a provision of DOL starting. Contractor to submit the voltage drop calculation, considering adequate fault level at 6.6 kV board.

The soft start system shall be based on principle of flux compensated non-saturated magnetic amplifiers for control of motor starting current. Also, the starter should not introduce any harmonics into the system.

The flux compensated magnetic amplifiers shall work on principle of flux opposition and operate in the linear non saturable zone of magnetic circuit. The system will work on constant mode in the starting zone so as to result in smooth start.

The enclosure class shall be IP52.

The Sheet steel thickness shall be 1.6 mm.

The control circuit will utilize auxiliary contacts and timers for starting function.

Lamp indication shall be provided using LED type lamps.

Ammeter shall be provided on front door.

The cubicle will have cable entry and exit from bottom through gland plate.

Bypass device used shall be 6.6kV contactor.

CONTROL & INSTRUMENTATION

General

Electronic type instruments generally working on 4- 20 mA DC signal system will be used. The instrument panel will be suitably installed in the compressor room. All instrumentation items will be selected to function satisfactorily in shop floor environment.

List of measurements & controls

For each compressor, the list of measurements & controls will include, but not limited to, the following:

i) Equipment/ local panel mounted measurements

- i. Indication of differential pressure across suction air filter for each compressor.
- ii. Indication of pressure of compressed air after after-cooler and after compressor.
- iii. Indication of temperature of compressed air after after-cooler and air compressor.
- iv. Indication of pressure of compressed air in air receiver.
- v. Indication of pressure of lube oil before & after oil cooler.
- vi. Indication of temperature of lube oil before & after oil cooler.
- vii. Indication of differential pressure across lube oil filter.
- viii. Indication of temperature at the inlet & outlet of common header of compressor cooling water circuit.
- ix. Indication of pressure at the outlet of common header of compressor cooling water circuit.
- x. Indication of flow of compressed air.

ii) Alarms and interlocks

01 Following audiovisual alarms and interlocks will be provided for each compressor:

- 1) Differential pressure of air across suction air filter high Alarm only.
- 2) Temperature of air after air compressor high- Alarm only.

- 3) Temperature of air after air compressor too high Alarm and trip.
- 4) Pressure of air after after-cooler high - Alarm only.
- 5) Pressure of air after after- cooler too high- Alarm & trip.
- 6) Differential pressure across lube oil filter high - Alarm only.
- 7) Pressure of lube oil to compressor low - Alarm only.
- 8) Pressure of lube oil to compressor too low- Alarm & trip.
- 9) Temperature of lube oil to compressor high- Alarm only.
- 10) Cooling water supply pressure low - Alarm only.
- 11) Cooling water supply pressure too low - Alarm & trip.
- 12) Motor over load - Alarm & trip.
- 13) Manual tripping- Alarm only

TESTING

Unless otherwise stated, main equipment, valves and other ancillary units will be tested to various stipulations stated in Indian Standards of BIS or any other reputed international standard listed.

Recommended tests on Air Compressors are listed hereunder. Compressors may be tested using a suitable shop motor.

- i) Volumetric and overall efficiency (type test)
- ii) Capacity (Routine test)
- iii) Specific power consumption from no load to full load (Routine test)
- iv) Speed (Routine Test)
- v) Testing of unloader (Routine test)
- vi) Safety valve test (Routine test)

All other tests will be performed in accordance with IS: 5456.

STANDARDS AND CODES

The complete system as a whole and individual equipment will be in accordance with the Indian Standards, British Standards, DIN or American Standards like ASME, ANSI or any other internationally accepted codes.

GUARANTEE AND PENALTIES

The Contractor will guarantee individual as well as integrated performance of all the equipment supplied by them for period as stipulated in the GCC prior to the date of issue of taking over certificate by the Employer. The final acceptance certificate will be issued by the Employer after successful commissioning of the Plant by the Contractor showing all the performance test at specified parameters.

The following parameters will be guaranteed at 35⁰ C, 60% RH, 33⁰ C cooling water temp., 50Hz frequency.

Air Compressor:

* Rated Capacity at lowest frequency	:	36 Nm ³ / min (each)
* Rated discharge pressure at the outlet of after cooler	:	8 kgf/cm ² (g)
* Discharge temperature after cooler at rated capacity and pressure	:	45 ⁰ C
* Oil content in the air at the outlet of air compressor,	:	Oil free
* Specific Power consumption of the compressor at the rated condition mentioned above (kwh/Nm3)	:	To be indicated by the Contractor
* Noise Level	:	80 dB(A)
* Volumetric efficiency of each compressor	:	To be indicated by the Contractor
* Inter cooler/ After cooler pressure drop	:	0.2 kgf/cm2 (max)

Tolerance on guarantee values of energy consumption, volumetric efficiency, intercooler & after cooler pressure drop is $\pm 0.00\%$

LIST OF PREFERRED MAKES

- **Compressor**

M/s Atlas Copco, M/s ELGI, M/s Ingersoll Rand, M/s Kirloskar Pneumatics.

- **Electrics**

1. **Motors**

Alstom Ltd., Asea Brown Boveri Ltd., BHEL, CGL, NGEF, Kirloskar Electric Co.

2. **Cables**

Cables Corporation of India,
Fort Gloster Industries Ltd.
Industrial Cable (I) Ltd.
Nicco Corporation Ltd.
Universal Cables Ltd.
Torrent Cables Ltd.

3. **Control Stations Weather Proof**

Baliga Lighting equipment Ltd., Bhartia Industries Ltd.
Electrical Equipment Corporation, Ex-Protecta,
Shrenik & Company.

4. **Light fittings & Accessories**

CGL, Philips, Bajaj.

5. **Actuators - MOV**

Auma India Ltd.,
Flow tork Inc. USA,
Continental Profiles Ltd.,
Rotork Control Ltd.

- **Instrumentation**

TRANSMITTERS (PRESSURE, FLOW & LEVEL) :

FUJI, YOKOGAWA BLUESTAR LTD., EMERSON, TATA
HONEYWELL LTD, ABB.

BARGRAPH INDICATORS :

FUJI, YOKOGAWA BLUESTAR LTD., MASIBUS ELECTRONICS.

DIGITAL INDICATORS :

YOKOGAWA BLUESTAR LTD., MASIBUS ELECTRONICS,
RANUTROL LTD.

MICROPROCESSOR BASED RECORDERS :

YOKOGAWA BLUESTAR LTD., LAXSONS ENGG. & ELECTRONICS
PVT. LTD.(CHINO), FUJI, ABB.

PRESSURE/TEMPERATURE GAUGES :

A.N. INSTRUMENTS PVT. LTD., GENERAL INSTRUMENTS,
MANOMETER (INDIA) LTD.

RTDs & THERMOCOUPLES :

GENERAL INSTRUMENTS, INDUSTRIAL INSTRUMENTATION,
INSTRUMENTATION LTD, NAGMAN SENSORS, TOSHNIWAL
BROTHERS.

TEMPERATURE TRANSMITTER :

YOKOGAWA BLUESTAR LTD, EMERSON, TATA HONEYWELL LTD,
ABB.

DIGITAL SCANNER:

JYOTI, LECTROTEK, PROCON, MASIBUS.

PRESSURE SWITCH :

INDFOSS (INDIA) LTD., SWITZER INSTRUMENTATION PVT LTD.

FLOW TOTALISER:

YOKOGAWA BLUE STAR LTD., FUJI, SIEMENS.

LEVEL SWITCH / SENSORS:**LEVEL GAUGE :**

J. N. MARSHALL & SONS, LEVCON INSTRUMENTS PVT. LTD.,
SIGMA.

SOLID STATE ALARM ANNUNCIATOR :

APPLIED ELECTRONICS LTD. (APLAB), PROCON
INSTRUMENTATION PVT. LTD., PIRI SYSTEMS PVT LTD., IIC,
MINILEC, MASIBUS.

POWER CABLES :

CABLE CORPORATION OF INDIA LTD., UNIVERSAL CABLES LTD.,
FORT GLOSTER INDUSTRIES LTD., ASIAN CABLES LTD, FINOLEX
CABLES LTD., KEI.

INSTRUMENTATION SCREENED CABLES :

CABLE CORPORATION OF INDIA LTD., FINOLEX CABLES LTD.,
TOSHNIWAL CABLES, DELTON CABLES, KEI, ASIAN CABLES,
UNIVERSAL CABLES.

COMPENSATING CABLES :

TOSHNIWAL CABLES, GENERAL INSTRUMENTS, UDAY RAJ, KEI.

B) AIR RECEIVERS

1 no. of Air Receiver of 4 m³ capacity for instrument air and 2 no. Air Receivers of capacity 6 m³ for plant air at 8 kgf/cm²(g) operating pressure, complete with all fittings such as safety valves, drain connection with auto condensate trap and bypass valve, vent connections and all inlet and outlet connections with companion flanges, supporting arrangement, access platforms, instruments etc. The material of construction will be as per IS – 2002 – Gr. – 2A . The air receiver will be designed, manufactured and tested according to IS – 7938, 1976 (RA 1991).

C) COOLING TOWER

Quantity : Three (3) sets (2W+1S) each of 40 cum/hr.

Type : Induced draft counter flow

Casing/ Basin : FRP

Frame Work : MS hot dip galvanized

Fills : PVC

Nozzles : Brass

Bolts, nuts, miscellaneous hardware : MS electro galvanized

Fan hub & blades : Cast Aluminium

Fan type : Axial flow, direct drive

Fan speed : 720 rpm

Degree of protection of motor : IP 55 (temperature rise limited to class

Ladder : Galvanised steel ladder with safety cage & hand railing up to the top of tower. Inclined to 30⁰ to the vertical

Eliminators : No. of deflector to be arranged to reduce drift loss < 0.2% of water circulation.

Cooling Tower Accessories:

- (i) Level switch at cooling tower basin (to be interlocked with pump)
- (ii) Make up connection with float valve (float made of copper) & back up ball valve
- (iii) Quick fill connection with ball valve
- (iv) Overflow connection
- (v) Drain connection with ball valve
- (vi) GI wire mesh 18 gauge strainer
- (vii) Equalizing line of cooling towers with isolation valves

03.00 BRIEF SYSTEM DESCRIPTION

03.01 DESCRIPTION OF EXISTING COAL HANDLING PLANT

03.01.01 Coal Preparation Plant No.1

- i) Rotary wagon tippler unloads incoming coal from WT#1 and 2 each having capacity of 800 tph and receives in two conveyor stream Y9-68 & Y9-69. Both the wagon tipplers are provided with electric pusher car on the inhaul side. The empty wagons are released over a gradient.
- ii) Coal from both the streams is fed, through a series of belt conveyors to the CPP-1 coal yard. One stream has toothed roller crusher while other stream has no crusher. Each of the streams has a capacity of 800 tph.
- iii) CPP-1 storage yard No. 1 has a storage capacity of 180,000 t.
- iv) Out of the three Nos. of gantry cranes in coal storage yard No.1 (i.e. CPP-1) only two nos. are existing at present which are planned to be phased out in future.
- v) Reclaimed coal from the storage yard is fed to storage cum blending bunker (15nos) in two rows via. Conveyor series of Y5-Y6. Coal is withdrawn from silos and conveyed to coal tower No. 1, 2 and 4 via junction house J3, J4, J5 and J6. (Presently battery no 5&6 are under rebuilding. After replacement of coal gallery Y6-38, CHP will feed coal to CT-3 also).
- vi) CHP has 4 nos. of hammer crusher of capacity 250 tph and two nos. of 200 tph.

03.01.02 Coal preparation Plant No.2

- i) Incoming coal is unloaded by rotary wagon tippler No. WT# 3 on conveyor no. Y9-87, Y9-88, Y9-90, Y9-91 (and finally stacked through stacker-cum-reclaimer I & II through yard conveyors Y9-94 & 95). Wagon tippler is provided with Electric Pusher Car on the inhaul side. The empty wagons are released over a gradient. Under rail hoppers are provided for manual unloading of coal from sick wagon.
- ii) Coal from the conveyor stream like Y9-87, Y9-88, Y9-90, Y9-91 etc. are fed to the series of belt conveyor by passing the preliminary crusher to the coal storage yard No.2 (CPP-2). The single line conveyor capacity is 800 tph upto the storage yard.
- iii) Coal storage yard No.2 (CPP-2 existing) have storage capacity of 120,000 t.
- iv) Provision of direct despatch of coal to the storage cum blending bunkers by passing the storage yard has been kept. The conveyor stream

capacity from the storage yard to the top of the storage cum blending bunkers is 800 tph.

- v) Coal is withdrawn from 14 nos silos in two rows- 7 nos in each row according to predetermined blend ratio in two streams and fed to the final crushing station No.2.
- vi) Four reversible hammer crushers of 300T/h have been provided for final crushing in crushing station No.2.
- vii) From final crushing station No.2, crushed coal blend is dispatched to junction No. 3F and finally to coal towers No. 5 and 6 and coal tower no 4 in case of constraint in coal supply of CHP.
- viii) Also new conveyors Y9-99A and Y9-99B have been commissioned in the year 2002 to have the provision for taking coal from CPP-2 coal yard to conveyor Y9-80 and Y9-81, so that coal can be fed to silos of batteries 1 to 8.
- ix) Blending is done through 14 nos of Belt weigh feeders/ Automatic Proportioning Device (APDs).

03.02 DESCRIPTION OF PROPOSED COAL HANDLING PLANT FOR COAL TOWER NO.- 7 OF COB#11 COMPLEX

1. General

In order to meet the enhanced required of coal for coke making, following additions, augmentation & modification to the existing coal handling plant is proposed:

- Addition of 5 nos. of RCC mixing bins (Silos), each of 500t storage in 3rd row of silos parallel to existing two rows of silos.
- Installation of 2 nos. additional reversible hammer mills (designated as hammer mill 7&8), each of capacity 300t/h in existing row of hammer mills after extending the existing final crushing station suitably.
- Replacement of existing hammer mills no. 5 & 6 by new hammer mills of 300 t/h capacity each, along with 630 KW slip ring reversible electric motors. Room for resistance banks & control panels for hammer mill no. 5, 6, 7 & 8 shall be provided in the new portion of the final crushing station.
- Upgrading & modification of existing collecting conveyors Y7-12 & Y7-13 to 1000 t/hr. rated capacity in the existing location with minimum shutdown.
- Connecting conveyor stream, connecting new coal tower no.-7 with existing coal handling plant.

- Connecting conveyor for new silos & new crushers to the existing Coal Handling Plant.
- 4 nos. split gates for coal handling plant on conveyors Y7-36, Y11-130, Y7-13 and Y11-134.

Flow diagram drawing no. MEC/S/9101/11/17/55/01/064.12/R0 (Sheet 1 of 2 & Sheet 2 of 2) and layout drawing no. MEC/S/9101/11/17/55/01/064.13/R0 showing the tentative location of proposed unit are enclosed for reference.

New conveyor Y11-125 will take feed from existing conveyor Y7-49 in the existing junction house 2C and feed conveyor Y11-126 with a traveling tripper to feed the individual silos (5 nos. new). Each silo will be of 500 tonne effective storage capacity. The vertical portion at a height of 1m and conical portion (slope 60°) shall be lined with 409M 8mm thick SS liner plate.

Each silo will be provided with identical Belt Weigh Feeder with PLC being provided in existing SILOS.

Silos shall be provided with pneumatic blow down facility. Bunker discharge mouth level shall be +10.2m and shall have floor at +6.2m level for laying conveyor Y11-127.

Belt weigh feeders will feed the coal to proposed conveyor Y11-127 and through conveyor Y11-128, the coal will be fed to existing conveyor Y7-35, which also carries coal from existing 2nd row of similar bunkers. The rated capacity of conveyor Y7-35 shall be 600t/hr. Conveyor Y7-35 will feed to modified conveyor Y7-36. The modification & strengthening of these conveyors are in the scope of contractor. Apart from replacing existing one way chute with split gate, conveyor Y7-36 shall be modified for accommodating split gate and upgraded to 600 tph.

Modified conveyor Y7-36 will feed the coal to existing conveyor Y7-51 & new conveyor Y11-129 through a bifurcated chute & split gate. Coal from conveyor Y11-129 will be fed to the new hammer mill nos. 7 & 8 through conveyors Y11-130 & bifurcated chute with split gate.

The existing final crushing building shall be extended suitably to accommodate new hammer mills (No. 7 & 8) and related items & electrics. The building shall be of RCC upto top floor with structural roofing. Each hammer mill shall have independent foundation.

In order to collect crushed product from the new hammer mills, the existing conveyor Y7-12 will be extended at the tail end adequately & it's capacity shall be upgraded to 1000 t/h rated capacity. The existing conveyor Y7-13 will also be upgraded to 1000 t/h rated capacity and will be provided with a bifurcated chute with split gate to enable feeding of

existing conveyors Y14 & Y18. These two conveyors shall have stand-by drives. The upgraded conveyor shall be provided with new drive (1W+1S), belt, 35 degree carrying and 10 degree return idlers. The drives of upgraded conveyor Y7-12 and Y7-13 shall be of 1 step higher rating. The belting shall be 1400mm wide and N/N grade of 1250 kN/m rating minimum.

The proposed stream connecting the new Coal Tower No - 7, comprises of new belt conveyor nos. Y11-131, Y11-132, Y11-133, Y11-134 & reversible shuttle conveyors Y11-135 & Y11-136. The existing chute feeding to the existing Conveyor No. Y-15 will be replaced by a bifurcated chute fitted with a 2 position motorised diverter gate to feed the new conveyor no. Y11-131. The coal will be conveyed to the new coal tower no.-7 via new conveyors Y11-131, Y11-132 & Y11-133 through new junction house no. 11A & 11B. The stream rated capacity shall be 600t/h.

Reversible shuttle conveyors Y11-135 & 136 shall be provided at the top of the coal tower no.-7. These shuttle conveyors shall be fed by conveyor Y11-134 through a split diverter gate. Each of the shuttle conveyors will be of 400 t/h capacity and shall be mounted on parallel tracks and can be placed on different compartments of the coal tower to uniformly distribute the coal charge in the coal tower. For this purpose suitable nos. of limit switches shall be provided.

Additionally, the coal tower shall be provided with 18 nos. of level monitors for giving continuous measurement of level of coal in the coal tower.

A belt weigh scale shall be provided on the new conveyor no. Y11-132 to indicate the flow rate & total quantity of coal fed to the coal tower.

The new equipment & conveyors shall be interlocked & controlled with the existing coal handling plant from the existing control room.

The existing system of LSTB shall be extended to all the new units up to the top of new Coal Tower no.-7 for communication.

Facilities for dust suppression, fire fighting facilities and proper illumination of galleries and junction house is included in the scope of work.

The conveyor drives of 30 KW and above shall be provided with fluid coupling. All coupling bolts shall be replaceable without shifting of drive components. Chutes shall be lined with 8mm thick 409M SS liners. Each discharge legs of the chutes shall be provided with chute jam indicators.

Flap/ Diverter gates shall be lined with 8mm thick SS 409M liner plates.

Each junction house shall be provided with Electric hoist. The Capacities of EOT Cranes / Electric Hoists for maintenance shall be at least 1.2 times the heaviest load – or – the Capacity & approximate height of some Junction houses are indicated as below:

Silo top	-	3t cap	-	37m lift	-	1no.
Jn. House 11E	-	2t cap	-	24m lift	-	1no.
Final crushing station	-	10t cap	-	10m lift	-	2nos.
New JH No.11A	-	2t cap	-	30m lift	-	1no.
New JH No.11B	-	3t cap	-	45m lift	-	1no.
Top of coal tower no.7	-	3t cap	-	50m lift	-	1no.

03.03 DESCRIPTION OF PROPOSED COKE SORTING PLANT FOR COB#11

03.03.01 Design Limits

Following design limits are to be considered for the proposed Coke Sorting Plant (CSP-4)

- a) From & including surge hopper in the junction house no.1. Junction house no.1 is included in the scope of the contractor.
- b) Upto & including junction house no. Z17 and upto & including discharge chutes of conveyors K11-21 & K11-22.
- c) Including upgradation of existing conveyor no. KD-1, modification of gallery of KD-1 is included in the scope of the Contractor.
- d) For coke breeze from the proposed conveyor KA-3 to the coke breeze bunkers & C3A-C2 with two way Diverter gate at Junction house JH-C3A. Nut coke from CSP coke breeze bunkers shall be disposed off by wagons and conveyor C3A-C2, for any exigency 100% disposal facilities by wagon will be provided.
- e) The discharge chute with pneumatically operated sector gate for coke car track from surge hopper in JH – 1 is in the scope of contractor.
- f) 3 nos. bin vibrators shall be considered for each bunker; hence, total no. of vibrators for coke sorting plant shall be 6.

03.03.02 Brief Description

A coke sorting plant of 300t/h capacity has been envisaged for the plant. The coke sorting plant will sort out the coke into three fractions i.e. 30-60 mm, 60-80mm & (-) 30mm. The coke will pass through a series of screens and coke cutters for this purpose. Flow diagram, layout, sections etc. are shown in drgs. MEC/S/9101/11/17/55/01/064.01 to 064.08.

The (-) 30mm fraction will be sent and stored in the 150t capacity RCC bunkers, after screening at 15mm. The other coke fractions will be sent through conveyors to Blast furnace stock house. In addition to the above, an open mechanized emergency coke storage yard of about 2500t capacity will be provided. Required conveyor streams, traveling

trippers will be provided for storage of coke. Coke will be reclaimed by an underground reclaiming conveyor as shown in the drawings.

Additionally a 1400mm wide 200 t/h conveyor streams shall be provided to carry BF coke from existing CSP-1 and feed to two numbers of 100t capacity RCC surge hoppers provided over conveyors K11-13 & K11-14. Each surge hopper shall be provided with level meters & belt weigh feeders to properly proportion the coke coming from CSP-1 & the new CDCP plant.

To take tapping from existing conveyor KD-1 a fixed tripper with a bifurcated gate shall be provided. One leg of the chute will feed coke to the new conveyor KA-1 of 1400mm wide & the other leg will feed the conveyor KD-1. A split gate shall be provided to enable feeding of coke to both the conveyors simultaneously. The walkway of conveyor KD-1 shall be suitably modified in the vicinity of the fixed tripper to facilitate movement of plant personnel.

All the buildings, junction houses, conveyor galleries will have adequate facilities like ventilation, illumination, hoisting and handling equipment, dust suppression facilities, etc. wherever necessary. All buildings shall be provided with LSTB system for communication.

Further, a dust extraction system shall be provided in the proposed Coke Dedusting Unit (CDU). A brief description of the same is given below:

03.03.03 Dust Extraction System with Air Blasting Unit

03.03.03.01 Brief Description

A dust extraction system with an air-blasting unit is to be provided in the coke-dedusting unit (CDU).

The system shall comprise dust extraction unit and air blasting unit. The dust extraction unit shall comprise suction hoods on the coke dedusting chute, ducting network, electrically operated dampers, bag filter unit, centrifugal fans, stack, electrics & control.

Bag filter unit shall consist of distribution chamber, filtering chamber with filter bags & fitting for the bags, outlet chamber, dust collection hopper with rotary air lock valves & screw conveyor, dust storage cum disposal hopper with rack & pinion gate and disposal chute, structural stair case and platform, timers etc. and one multiclone and one spark arrestor in the ducting network at the inlet side of distribution chamber of bag filter unit. (these two equipment are required to collect the hot/ glowing coke particles thereby preventing them to enter into bag filter). Two suction ducts of the ducting network shall be provided with electrically operated dampers & flanges for connecting them with the coke dedusting unit (CDU) chambers (2 nos.) separately.

The air blasting unit shall consist of air intake louver, transition piece, centrifugal blasting fan, main duct and two numbers of branch ducts with electrically operated dampers & flanges.

03.03.03.02 **Arrangements and the Components:**

The air intake louver of air blasting unit shall be installed in the opening of wall exposed to ambient. This shall be connected to suction side of blasting fan through transition piece. The delivery side of this fan shall be connected to ducting network. The branch ducts (2 nos.) shall be connected to both the coke deducting unit (CDU) chambers through the flanges separately. There shall be two air stream/ paths, one working & one standby, from air blasting unit to dust extraction unit, through CDU chamber. The material flow in the CDU chambers conceptually shall be perpendicular to the airflow of air stream from blasting unit to dust extraction unit. Electrically operated dampers provided in the air stream at the both sides of CDU chamber shall be interlocked with the operation of CDU chambers; this is required to isolate the stand by CDU from air stream and to take the working CDU into air stream of our above system.

03.03.03.03 **Functional Description**

While running the CDU, air blasting unit fan shall suck ambient air through air intake louver & transition piece and blast/ supply the air into the CDU through the ducting network.

The working of the dust extraction unit shall suck the air dust laden air including blasting air shall be sucked from CDU and hot/unburnt glowing coke particles shall be collected in multiclone and spark arrestor placed in the ducting network at the suction side of bag filter. The dust disposal from bag filter, multiclone & spark arrestor shall be through discharge into a central pneumatic system (through dust storage hopper). However, central pneumatic system shall not be in the scope of Contractor.

03.03.04 **Major Facilities**

03.03.04.01 **The major scope of work of Coke Sorting Plant** comprising of Coke crushing station, coke screening station, coke breeze bunkers, emergency coke storage yard, coke dedusting units, junction houses, traveling tripper bridge, galleries and associated mechanical, civil, structural, electrical works of COBP # 11 is given below: -

- 2 nos. grizzly screens (80mm), capacity 300 t/h.
- Grizzly shall be of Manganese steel casting DISC and the underpass chute liners should be cast Basalt 110mm thick
- 2 nos. coke cutters (+80mm) capacity 180 tph.

- 2 nos. vibrating screens, (30 mm) capacity 300 t/h. Screen wires should be 5 mm dia SS.
- 2 nos. grizzly screens (60 mm), capacity 200 t/h. Grizzly specifications and chute liners shall be same as mentioned above.
- Conveyor stream capacity 300/150 t/h.
- 2 nos. variable speed belt weigh feeders 20t/h to 100 t/h.
- Chain samplers – 2 nos., one each for different BF coke fractions.
- Belt conveyors as per conveyor data sheets.
- Belt weighers shall be provided on Coke Conveyors K11-11, K11-12, K11-15, K11-16 & conveyor K11-18.
- Capacity up gradation of existing conveyor KD-1 to 400tph from 300tph.
- Capacity of conveyor staying from conveyor KD-1 to the CSP-4 shall be 300t/h.
- All chutes should be box design to avoid direct fall of Coke on Chute liners.
- Only Cast Basalt/ Ceramic liners of 110 mm thk are to be used in Coke Transfer Chutes.
- DE system shall be provided for dust extraction at all transfer points.
- Control room & maintenance room shall be provided in coke screening station.
- Automation & control facilities shall be interfaced with coke oven battery operation.
- The extension of existing conveyor stream comprising conveyors KA-2/KA-3 to the new breeze bunkers of CSP-4 for onward conveyance to SP-3.
- Wagon loading shall be provided for BF coke in the coke screening station of CSP-4.
- Shift in-charge & supervisor room shall be air condition.
- Maintenance post with Air Conditioned Supervisors room along with shift in changes room and toilet block is to be provided in the Coke Screening Station.
- Handling & Hoisting facilities: All Junction houses shall be equipped with suitable handling & hoisting facilities. Junction houses below 6m height shall have suitable capacity (2t min.) manual hoist and more than 6m

height shall have electric hoists. Under slung & EOT cranes as required in CS and other handling facilities as specified in system description shall be provided.

- 1 no. mobile belt coiler / decoiler type belt changing device and 2 nos. hot vulcanizing unit suitable for 1600 mm belt width. Contractor shall also to provide guide rollers at required locations for coiling / decoiling of belt near each junction house / take up unit.

03.03.05 **Other Features**

In addition to the above, following is to be provided in this package by the Contractor.

1. The capacity of the belt weighers shall be 1.2 times the rated capacity of the respective conveyors.
2. The two way diverter gates shall be of robust design and of wear resistant material for longer life.
3. Flap/ Diverter gate drives shall be of adequate rating to take care of dirty conditions of the chute's interior.
4. Flap/ Diverter/ split gate, surge hoppers etc shall be lined with 10 mm thick 'Hardox 500' material with CSK bolting.
5. RCC bunkers/ under-ground hoppers shall be lined with 8mm thick SS-409M Stainless Steel.
6. Scrapper/ breeze chutes should have a minimum inclination of 70 degree and should be made up 409M SS.
7. In case of bifurcated chutes, where steep angle scrapper chute is not possible, the scrapper shall be provided in the main chute with proper design to ensure easy accessibility for removal of scrapper for maintenance purpose.
8. Suitable windows shall be provided in chutes & scrapper chutes to enable proper cleaning of the chute's interior.
9. The yard surface slope shall be such that drainage is outward.
10. Side sheeting & roofing shall be of suitable material and shall be properly fixed to ensure longer life in corrosive atmosphere.
11. Fiber glass roofing & sheeting shall be provided at suitable intervals for proper illumination in the galleries.
12. Each underground hopper in the stockyard shall be provided with manually operated sector gates.

13. Yard reclaim conveyor K11-10D shall be 1600mm wide with 35° troughing angle and without skirt board.
14. Discharge chutes shall be lined with 110mm thk. liners/ cast basalt liners.
15. Anti-corrosion painting shall be provided on all structures.
16. Silos shall be lined with 8mm thick SS-409M with SS steel coping at 1m high in vertical & complete in slope portion.
17. DE system shall be provided for dust extraction at all transfer points.
18. Grizzly screens discs shall be of high manganese cast steel.
19. All types of gear boxes shall be supplied with input shaft with matching gear wheel assly.
20. Control room & maintenance room shall be provided in coke screening station.
21. Automation & control facilities shall be interfaced with coke oven battery operation.
22. The control room shall be provided with package type AC.
23. Existing conveyor KD-1 shall be renovated with following features.
 - i) Capacity : 400t/h
 - ii) Belt width : 1400m
 - iii) Troughing Angle : 35°
 - iv) To be provided with fixed tripper
 - v) Drive to be changed accordingly.
 - i) For disposal of coke breeze from CSP-1, the existing conveyor stream comprising conveyors KA-2/KA-3 shall be extended to the new breeze bunkers of CSP-4 for onward conveyance to SP-3. Nut coke from CSP coke breeze bunkers shall be disposed off by wagons and conveyor C3A-C2. For any exigency 100% disposal facility by wagon will be provided.
 - ii) Nut coke from CSP-1 shall disposed off by wagons as per present practice.
 - iii) Nut coke from CSP-4 bunkers shall also be disposed off by wagons/ road. Facility for the same shall be provided.

24. Wagon loading shall be provided for BF coke in the coke screening station of CSP-4.
25. Maintenance post with Air Conditioned Supervisors room along with shift in changes room and toilet block is to be provided in the Coke Screening Station.

Conveyor belt width, troughing angle and belt width will be properly selected to prevent coke spillage. Conveyor galleries, buildings will follow IPSS norms and will be provided with adequate maintenance facilities and space.

Coke crushing station, coke screening station, coke bunkers and junction house no. 1 & coke dedusting unit shall be of civil construction upto the top floor, above which it shall be of steel structure.

Other Junction Houses & travelling Tripper Bridge shall be of steel structure with RCC flooring.

Electric hoists/ manual hoist of suitable capacity & lift shall be provided in each junction house & buildings to cater to the maintenance needs. Electric hoists shall be provided wherever height of lift is more than 6 meters.

03.04 Brief System Description of Augmentation in Flux - Fuel Preparation and Plant return fines handling for SP III

The turnkey package of this CS also comprises of the following sub-systems:

- **Up gradation / Addition of coke crushing and screening and grinding facilities**
- **Up gradation/ addition of Flux crushing & screening facilities in an integrated manner.**
- **Transportation of Fines from Blast Furnace nos.1 to 7 & BF # 8 to Existing Junction house JH-127**
- **Transportation of Coke Breeze from CSP#4 to Conveyor C102 in an integrated manner.**

Brief descriptions of the various sub-systems are given below and are also reflected in the drawings enclosed. However the Contractor shall consider the contract drawings only as indicative and any changes for completeness and improvement shall be finalized during submission of basic engineering document for approval by the Contractor.

03.04.01 RECEIPT OF RAW MATERIAL

Presently iron ore fines and fluxes are being conveyed to SP-III from existing Ore Handling Plant (OHP) through two series of belt conveyors and coke from existing Coke Sorting Plant (CSP) by dump-cars unloaded in an underground hopper & through a series of belt conveyors. All the three conveyors pass through JH-111A. This system is adequate to feed both strands (existing & proposed) of Sinter Plant-III.

Sieve analysis of raw material input to fuel & flux crushing & Screening circuit

1. Lime Stone (received from Koteswar)

Max		Min	-	%
+ 75 mm			-	2.0%
- 75 mm	to	+ 60 mm		15.0%
- 60 mm	to	+ 50 mm	-	16.6%
- 50 mm	to	+ 30 mm	-	40.2%
- 30 mm	to	+ 25 mm	-	9.2%
		- 25 mm	-	17.0%

Moisture- 15%

2. Raw Dolomite

Max		Min	-	%
+ 60 mm			-	1.3%
- 60 mm	to	+ 50 mm	-	7.3%
- 50 mm	to	+ 20 mm	-	44.9%
- 20 mm	to	+ 10 mm	-	16.7%
- 10 mm	to	+ 6 mm	-	14.3%
		- 6 mm	-	15.5%

Moisture- 15%

3. Coke Breeze

Max		Min	-	%
+ 25 mm			-	4.3%
- 25 mm	to	+ 15 mm	-	12%
- 15 mm	to	+ 10 mm	-	11.5%
- 10 mm	to	+ 5 mm	-	15.3%
- 5 mm	to	+ 3 mm	-	16.5%
		- 3 mm	-	40.4%

Moisture- 10% (normally), 15% (in rainy season)

Tentative size distributions of raw material (sizes as required in this CS) are shown in Table: 05.01 below. Further, the product/ output of crushed fuel & flux shall be in accordance with the sizes is also given below:

Table: 05.01

Sl no	Material	Size Distribution (mm)	Percentage
1	Iron ore fines	- 8 mm	+8mm (5% max.)
2	Lime stone/ Dolomite (Crushed)	- 5mm - 3 mm - 1 mm	100% 95% (Minimum) 70%(Minimum)
3	Coke breeze (Crushed)	- 5mm -3 mm -1.0mm -0.5mm	100% 90% or above Not to exceed 50% Not to exceed 30%
4	Mill scale	- 8 mm	+8mm (5% max.)

5	BF sinter return fines	- 8 mm	+8mm (5% max.)
6	Flue dust	- 1 mm	+1mm (5% max.)

03.04.02 **ADDITIONS/ MODIFICATIONS AND UPGRADATION IN EXISTING RAW MATERIAL PREPARATION SYSTEM**

03.04.02.01 **EXISTING FUEL crushing and screening facility**

There is a provision of covered storage for coke breeze received from blast furnace adjacent to coke crushing and screening building. The coke breeze is reclaimed by front end loaders and conveyed to coke crushing and screening building through series of conveyors C101, C102, C103, C104, C105 and finally C106. The coke breeze gets crushed by 2 roll crusher to -10 mm from -25mm size and subsequently screened by Mogensen sizer. +3mm output from the sizer is conveyed to coke grinding building by conveyor C111 and discharged onto reversible conveyor C112. Conveyor C112 discharges into 2 nos. surge bins from where belt feeders extract material and feeds to rod mill (2 nos.) where it gets crushed to -3mm. (-)3 mm size from crushing and screening building is directly conveyed and discharged onto conveyor C114 through conveyors C110 and C113, which in turn discharges to conveyor C 115.

03.04.02.02 **Existing FLUX crushing and screening facility**

Limestone and dolomite required for the existing machine of Sinter Plant III is drawn from bunkers of flux proportioning building and conveyed by conveyor 105 to surge bin of existing flux crushing building. The material is discharged onto reversible shuttle conveyor L106 from where it is discharged onto bins. The material is withdrawn by vibratory feeder and fed to primary hammer mill (3 nos.) of 250tph capacity. From the hammer mills the crushed flux is conveyed by conveyors L109, L110 and L111 onto secondary hammer mills (3 nos.) These three conveyors carry crushed flux to flux screening building and discharge into surge bins(3 nos.). Material is withdrawn from each of the two openings by traveling

vibro feeder (6nos.) and fed to flux screens (6 nos.) for screening -3mm size fraction. The under size (-3 mm) from each of the six screens is fed to a common conveyor L120 which conveys the material onward to storage and proportioning bin building. The oversize (+3mm) is fed to a common conveyor L115 and recycled back to flux crushing building for further crushing.

03.04.02.03 **PROPOSED Fuel and Flux Crushing and Screening Facility**

In order to cater to increased requirement of fuel and flux for the new sinter machine, following three facilities have been envisaged under this package which shall form part of scope of this Contract:

- Up gradation / Addition of coke crushing and screening facilities.
- Up gradation / Addition of Coke Grinding facilities
- Up gradation/Addition of Flux crushing & screening facilities.

The existing facilities also need to be modified/ extended so as to integrate the existing with proposed facilities.

03.04.02.03.A **UP gradation / Addition of coke crushing and screening and grinding facilities**

A similar facility for coke breeze crushing, screening & grinding with related facilities shall be added adjacent to the existing one.

As described earlier that the coke breeze is being received from the existing track hopper via belt conveyors C101, C102, C103, C104 to the coke storage yard. It is now proposed that Coke breeze & BF return fines shall also be received by conveyor C-102 for further transportation to coke storage yard. Belt conveyor C-104 shall be suitably modified & extended and discharge onto new reversible conveyor RC 106. RC 106 shall be able to discharge either onto existing conveyor C106 or onto new conveyor C106A in a new Junction house CK-1. Conveyor C-106A shall carry the material to feed over a hopper of capacity 200m³ (effective volume) with suitable gate at proposed New Coke crushing house CK-2. A reversible belt conveyor RC-CK2 will receive the material

from bunker and feed either to the two roll crusher or bypass the crusher and feed to conveyor C107A as shown in the flow diagram. The two roll crusher shall be of capacity 50 tph and shall receive -25mm (10-15% moisture) coke breeze, crush and discharge over conveyor C-107A. Conveyor C-107A shall further transfer Crushed/ bypassed uncrushed material to Junction house CK-3 and discharge over a Mogensen Sizer of capacity 50 tph for product size of (-3) mm. The oversize (+ 3 mm) from sizer shall be discharged onto conveyor C-111A which shall convey and discharge the material onto new conveyor C- 112A in new coke grinding building. Conveyor C-112A shall discharge into either of two nos. surge bins of effective capacity ~100 m³ each from where material shall be withdrawn by Belt feeder and fed to rod mill. Sized material (-3mm) from rod mill shall be discharged onto existing conveyor C-114, which shall further convey the material to existing storage and proportioning bin building through existing conveyors C115, C115A and C115B.

It may be noted that input material of size -25mm and product material of size -3mm is the basic system requirement of the integrated fuel crushing and screening system. The facilities envisaged between input stage to output stage have been given in the CS. Crushing of coke at two roll crusher, screening at coke sizer and grinding at rod mill shall be decided by the contractor in an integrated manner to given the plant output of -3mm.

03.04.02.03.B Up gradation/Addition of Flux crushing & screening facilities

An additional stream similar to the existing one consists of Primary & Secondary Hammer Mill with surge bin & vibro-feeders and related facilities shall be provided by extending flux crushing building. Further screens with surge bin & vibro feeders in screen building with feeding conveyor from crushing building to screen building shall be provided.

Limestone and dolomite required for the existing machine of Sinter Plant III is drawn from bunkers of flux proportioning building and conveyed by

the conveyor L105 to surge bin of existing flux crushing building. It is proposed to extend the existing conveyor L 105 by nearly 7.3 m to new proposed extension of flux crushing building.

The existing reversible shuttle conveyor L-106 shall be replaced by new one of larger length so that it can feed existing three crushing series surge bins as well as a new crushing series surge bin (200 m³ effective volume each). New series having a Primary hammer Mill shall receive the material from respective surge bin through vibro-feeder and after crushing it will discharge onto a new conveyor L111A. Conveyor L111A shall further feed the crushed material to secondary Hammer Mill. After crushing in secondary crusher, the material shall be conveyed to new surge bin in the screen building (100m³ Effective volume) with the help of a new belt conveyor L114A. The surge bin of this screen building shall have two discharge points so as to feed the new two nos. screens.

The undersized material (-3mm) shall be received by the existing conveyor L120. The tail end, horizontal gravity take up arrangement, electrics, control, etc. of belt conveyors L120 shall be suitably extended backward to receive the above material from Screens.

The over sized material (+3 mm) shall be recycled through existing conveyors L115, L116 & L117 to the Crushing building. The tail end, horizontal gravity take-up arrangement, electrics, control, etc. of belt conveyors L115 shall be suitably extended backward to receive the above material from Screens. Belt conveyor L117 shall further discharge the material onto the new reversible shuttle conveyor L118. The existing reversible shuttle conveyor L118 shall be replaced by new one of larger length so that it can feed existing three surge bins as well as a new surge bin (75m³ EV). The surge bins will then discharge the material over the same (as referred above) new secondary Hammer Mill with the help of Vibro-Feeder. The material shall be further crushed and fed to the screens as described above.

Flow diagram and Layout drawing for **Proposed Fuel and Flux Crushing and Screening Facility** of Sinter Plant-III is enclosed as Drg. No: MEC/S/9101/11/17/01/55/064.18/R0 and MEC/S/9101/11/14/0/A/00/064.2522/R2 for reference.

03.04.02.04 RE-ROUTING OF EXISTING SINTER FINES CONVEYORS (C-LINES).

The existing series C-line conveyor is feeding BF return fines from existing Blast furnaces to the sinter return fines (IPRF) conveyor F101 of SP-III at JH-127. It is now proposed to dispatch these return fines straight to the same conveyor with strengthening & modification of gallery. The same shall be executed by dismantling & re-routing of the existing C-line conveyors so as to install new CDCP unit in place of C-line Belt conveyor no. C3, and hence the existing C3, C4, C5 & C6 belt conveyors require relocation.

Dismantling of the existing belt conveyors C3, C4, C5 & C6, related galleries & junction houses no.-3, 4, 5 & 6 is included in the scope of the contractor. Junction house - C2 shall be suitably modified to re-install the tail end of new conveyor-C3 from perpendicular direction as shown in General layout drg. No. MEC/S/9101/11/14/0/00/00/064.03/R0.

Belt Conveyor No. C3 shall be re-routed and re-installed (two conveyors C3A-C1 & C3-C1) along the existing gallery of JH124 & 123A/B adjacent to railway tracks so as to feed the fines at relocated junction house -C3. Belt Conveyor C3A-C1 shall receive BF return fines at JH-C2 and discharge onto conveyor C3-C1 as well as conveyor C3A-C2 shall receive coke breeze from CSP#4 and discharge onto conveyor C3-C2 at Junction house JH-C3A. These two belt conveyors i.e. C3-C1 & C3-C2 together carry the material through common gallery and discharge onto belt conveyor C4-C1 & C4-C2 respectively. Belt conveyor C5-C1 (Sinter/ore fines) and C5-C2 (Coke fines) shall receive the material from BF#8 Stock house and discharge over C6-C1 and C7-C1 respectively at JH-C5. Also Conveyor C4-C1 and C4-C2 shall discharge the material over

conveyor C5-C1 & C5-C2 respectively at JH-C4. Conveyor gallery C5-C1 & C5-C2 shall cross over the existing gallery of conveyors between JH-120 & Emergency Sinter Storage Building.

Belt conveyor C6-C1 shall carry the Iron bearing fines (BF return) and discharge over conveyor J127-C1 at JH-C6 and in turn to F101 existing Belt conveyor at JH-127. Junction house JH-127 shall be suitably modified so as to accommodate drive and discharge end of belt conveyor J127-C1. Existing drive and discharge of belt conveyor C6 shall be dismantled before installation of new conveyor J127-C1. Belt conveyor C7-C1 shall discharge the material over belt conveyor C102A at Junction house JH-C7 and in turn feed to existing belt conveyor C102 at pent house. As a storage capacity of 12 hrs has been envisaged in BF#8 return coke bunker in BF#8 itself, no separate storage/ surge bin has been considered in C102A to C102 conveyor transfer points. Suitable gallery structure to place drive/ discharge end of conveyor belt C102A, de-dusting system, skirt board & impact idlers on existing conveyor C-102 shall be provided to receive coke breeze. The pent house roof shall be locally dismantled to enable erection of transfer house and discharge onto conveyor C-102. However, after installation of new Junction house over pent house, the roof & structure of pent house may again be utilized to cover remaining part of pent house.

Two dedicated routes shall be provided to transport Iron bearing material (BF return fines) till existing belt conveyor F101 of SP-III and coke fines from coke sorting plant & BF#8 stock house till existing belt conveyor C102 of SP-III. A common gallery may be considered for all parallel conveyors.

Floors of Conveyor galleries of all return line conveyors from junction house C2 to new junction house J127 & pent house of C102 shall be of chequered plate construction (Minimum 8mm O/P) with semi circular hood over conveyor.

Rerouting of these conveyor series shall be so meticulously planned that minimum shut down is required in the existing plant. Design, supply, erection, commissioning and performance guarantee test of the Re-routed conveyors are under the scope of the Contractor. Existing equipments/ components of dismantled (by the Contractor) conveyor/gallery/ junction houses shall not be re-used.

All Proposed junction houses shall have Electric hoist. The capacity & lift may be followed as per CS. Junction houses (where these facilities are not considered) of below 6m height shall have suitable capacity (2t min.) manual hoist and more than 6m height shall have at least 5t cap electric hoists. Under slung & EOT cranes as specified in CS and other handling facilities as specified in system description shall be provided.

04.09 INSTRUMENTATION & CONTROL

04.09.01 GENERAL

01. This document is intended to define the basic requirements for instrumentation system for Coal Handling Plant & Coke Sorting Plant for COB #11 and Flux & Fuel Preparation and Plant Return Fines Handling for SP-III coming under the 7.0 MTPA expansion of Bhilai Steel Plant (BSP) with a view to achieve smooth, efficient, safe and reliable operation of the process.
02. This document, read together with the Instrumentation & Automation part of the General Technical Document (No.GS-03), General Conditions of Contract (GCC) and other commercial terms & conditions, will form the Contract document pertaining to Instrumentation & Control System of Coal Handling Plant & Coke Sorting Plant for COB #11 and Flux & Fuel Preparation and Plant Return Fines Handling which will be complied by the Contractor while executing the package.
03. Measurement and control equipment supplied for the process will be complete in all respect in line with this document. Any equipment / accessories not explicitly indicated in this document, but considered essential for proper functioning of technological equipment and process are included in Contractor's scope of work and supply.
04. Monitoring, sequential operation, alarm & interlock functions for the process & equipment of the Coal Handling Plant & Coke Sorting Plant for COB #11 and Flux & Fuel Preparation and Plant Return Fines Handling for SP-III will be achieved through automation system. All instrumentation facilities will be interfaced with automation system accordingly. The requirement regarding automation system has been separately described under 'Automation system (level-1)' chapter of this Document.
05. Instrumentation system of the plant will be in general, Field Bus compatible and will be interfaced with the automation system having Field Bus interface modules. However, in cases, where some instruments are not available with Field Bus compatible features, conventional instrumentation equipment (SMART & 4-20 mA DC signal output) will be supplied. Signals from these instruments will be interfaced through hardware input/ output modules of the automation system.
06. All field-mounted level transmitters will be radar type. Suitable enclosures will be provided at field for the controller/ electronic unit of the level transmitters. Other features of the instrumentation facilities will be as indicated in the Instrumentation part of General Technical Document (No.GS-03). Level transmitters will measure accurately & reliably the level of bulk solids and powders during fill cycle regardless of the dust or material variation in density or moisture.

For high level interlock, suitable contact type level switches to be considered.

07. If required, air purging of level sensor (radar type) will be provided. All necessary tubes/pipes, valves, pipe fittings etc. for the same will be provided by Contractor.
08. The field signals which are to be interfaced with the I/O system or Field Bus interface modules of automation system, will be connected to the nearest Remote I/O stations of the automation system considered for that area/ unit. Suitable junction boxes will be considered as per the finalized requirement. The cabling activities will be carried out as per the finalised cable schedule and wiring & termination drawings of the Contractor.
09. All the instrumentation equipment will be brand new & supplied from the latest product ranges of reputed manufacturers as per the List of Preferred Makes, indicated at clause no. 04.09.06. Employer/ Consultant reserve the right of selecting particular make and model of instrumentation equipment with a view of standardisation of the whole plant. Contractor will comply with such requirements. In case, certain instruments to be supplied by Contractor as per his standard design and system requirement whose make has not been indicated in the document, Contractor will propose make of such items with credentials and catalogues for Employer/ Consultant's consideration.
10. Contractor will execute complete instrumentation package on turnkey basis to the satisfaction of Employer/ Consultant. Contractor will comply with all the requirements indicated under General; Scope of Work and Supply; List of measurement, control, alarm & interlock; Submission of drawings & documents and other related clauses/ annexure included in this document.
11. Temperature measurement under package units & motors will be connected directly to respective automation system's temperature input card.
12. All correspondences / documents will be in English language and for all the data, drawings & documentation metric or SI units will be followed.

04.09.02 SCOPE OF WORK AND SUPPLY

Contractor's scope of work and supply will include design; engineering; manufacture/ procurement; assembly; calibration; shop testing; inspection at works & at site; painting; packing; transportation to site including loading, unloading, storage & handling of all instrumentation equipment including electrical accessories, cables, pipes, erection accessories, panels/ cabinets and all associated hardware, as required for completeness of

instrumentation system in all respect along with site fabrication, erection, testing, commissioning of the complete instrumentation system for completeness & satisfactory stable operation of Coal Handling Plant, Coke Sorting Plant for COB #11, Flux & Fuel Preparation and BF Return Fines Handling for SP-III. The scope of work will also include liquidation of defect points, participation in tests for establishment of plant performance guarantee (PG) and post commissioning activities till issue of final acceptance certificate (FAC) by BSP.

The scope of work and supply will also include, but not limited to, the following:

1. Instrumentation equipment as per the measurement list covered under clause number 04.09.03 of this document.
2. Field bus devices, Field bus interface modules, Field bus cables, terminators, couplers, connectors, power supply modules, power conditioners, surge suppressors, repeaters, Field bus junction boxes, T devices, pull boxes, etc., required for completeness of implementation of Field Bus based system.
3. All maintenance, diagnostic tools & devices required for implementation, maintenance & trouble-shooting of Field Bus system.
4. For air purging of instruments to remove/avoid dust accumulation (if required), all required with piping, pipe, fittings valves etc.
5. Supply of testing equipment, tools & tackles as per clause no. 04.09.05.
6. All electrical accessories for instrumentation system including UPS and other instrument power supply equipment as applicable.
7. All types of control, signal, LT power & special cables, as required for this package.
8. Fully wired cabinets/ panels, junction boxes, pull boxes, transmitter cabinets, etc. Suitable panels for electronics units of the level transmitters and transmitter cabinets/ junctions boxes for the transmitters & connectors for the field bus based instruments, etc., will be provided and properly located at the field/ rooms.
9. Galvanized trays, conduits, protection pipes, fittings, steel structures & frames, erection hardware & accessories, as required for this package.
10. Submission of drawings and documents as defined in this document.
11. Erection, testing, calibration and commissioning of the total equipment included in this document. Contractor will arrange tools, tackles and consumables as may be required for erection, testing, calibration and commissioning activities.
12. One no. hand held universal type calibrator (Lap top based) having sufficient memory capacity and with battery & battery charger as required for calibration of all level transmitters. All the necessary software will be loaded in the calibrator.
13. Preparation of earthing pit, supply of earthing materials including cables and installation of separate earthing system for case earthing, power and instrument signal earthing.

14. Arrangement of and participation in inspection of Instrumentation equipment by Employer/ Consultant. Inspection and Testing will be carried out in compliance with the Quality Assurance Plans, to be approved during detailed engineering stage.
15. Scope includes arranging visits by respective instrumentation equipment manufacturer's representatives at site, as & when required, during erection & commissioning.
16. Providing training to Client's personnel on special instrumentation equipment, at manufacturer's works and also at site.
17. Two years maintenance spares, if the order is separately placed by Employer.
18. Commissioning spares and three months consumables.
19. Supply of all instrumentation items from "list of preferred makes" as indicated at clause no. 04.09.06. From the list, for any particular type of instrument, only those vendors will be selected which are field bus compatible. However, for a particular type of instrument, if no vendor can provide field bus compatible instrument, then conventional type can be supplied.
20. Compliance with Instrumentation part of 'General Technical Document' .

04.09.03. LIST OF MEASUREMENTS

An indicative list of measurements, alarms & interlocks for Coal Handling Plant, Coke Sorting Plant for COB #11, Flux & Fuel Preparation and Plant Return Fines Handling for SP-III is given below. However, Contractor will supply all the measurements, alarms & interlocks as may be required for efficient & satisfactory operation of the system. Unless specifically mentioned, all monitoring of the process parameters will be achieved in level-1 automation system and displayed in HMI stations and field instrumentation equipment will be supplied accordingly

A) Coal Handling Plant:

The measurements for Coal Handling Plant will include, but not limited to, the following:

- i. Level measurement of coal towers (18 nos.): For each tower minimum one no. of level transmitter (radar type) and one no. of high level switch will be provided. These signals will be hooked up with the automation system for alarms and necessary interlocks. The required no. of level transmitters will be provided as per the bunker design. For interlocks, separate high level switches for each bunker will be provided as per the process requirement, no. of feeding points etc.
- ii. Level measurement of new silos (5 nos.): For each silo, 2 numbers of radar type level transmitters and 4 numbers of level switches per silo will

be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.

B) Coke Sorting Plant:

The measurements for Coke Sorting Plant will include, but not limited to, the following:

- i. Level measurement of bunkers (4 nos.): For each bunker one no. of level transmitter (radar type) and one no. of high level switch will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.

C) Fuel & Flux Crushing & Screening system:

The measurements for Fuel & Flux Crushing & Screening system will include, but not limited to, the following:

- i. Level measurement of bunkers (6 nos.): For each bunker one no. of level transmitter (radar type) and one no. of high level switch will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.
- ii. Level measurement of bunkers (1 no.): For this bunker two nos. of level transmitters (radar type) and two nos. of high level switches will be provided. These signals will also be hooked up with the automation system for alarms and necessary interlocks.

04.09. 04. LIST OF DRAWINGS & DOCUMENTS

Following drawings and documents will be submitted by the Contractor for Instrumentation system:

I) For Approval :

01. Finalised process and instrumentation (P & I) diagram indicating all local & remote measurements, alarms and interlock functions, using ISA symbols and using suitable tag numbers against each instrumentation equipment.
02. Finalised list of measurements, alarms & interlocks, along with BOQ and document of each instrumentation item indicating make, model number, scale range, quantity, application and tag number (as per P&I diagram).
03. Detailed specification datasheet for each instrumentation item, filled in as per the format finalized for this plant.
04. Overall general arrangement drawings & sectional views of various cabinets, panels, consoles, etc., showing internal disposition of all components/ units, with dimensional details and bill of materials.

05. Single line power supply diagram with document and bill of quantities of electrical accessories along with that of UPS.
06. Quality assurance plan for each instrument & control system.

II) FOR SCRUTINY AND RECORDS

01. Detailed technical literature/ catalogue for each instrumentation item.
02. Instrument Installation/ Hook up diagrams with bill of materials.
03. Instrumentation layout drawings showing location of instruments and route of cables from these upto control room.
04. Wiring and termination diagrams with details of termination of field signals to local JBs/ panels and from JBs to panels/ marshalling racks/ cabinets including internal wiring drawings.
05. Cable schedule.
06. Manufacturer's test, calibration and guarantee certificates for all instruments.
07. Operation and maintenance manuals for instruments.
08. 'As-built' documentation.
09. Soft copy of all the above drawings & documents in CD-ROMs/ DVDs.

04.09. 05 LIST OF TESTING EQUIPMENT

Following testing equipment pertaining to Instrumentation will be supplied by the Contractor:

1. 4-1/2 Digit Digital Portable Multimeter

Make	Fluke/ Yokogawa/Philips
Quantity	2 Nos.
Type	Portable & handheld type
Display	4-1/2 digit, LCD
Range:	
DC Voltage --	Selectable upto 1000 V min.
DC Current –	Selectable upto 10 A min, and will be capable to measure mA signals for instrument use
AC Voltage –	Selectable upto 1000 V min.
AC Current –	Selectable upto 10 A min
Resistance—	Selectable upto 50 M Ohm min.
Capacitance—	Selectable upto 10 mF min.
Frequency--	10.00 KHz to 199.99 KHz.
Other facilities	The multimeter will have the facilities like Diode testing, Continuity testing, Data hold facility, Auto hold facility, Auto power off facility, and with alligator clips, holster, temperature probe, battery, user manual & operator's guide. Multimeter will be suitable for true

	RMS measurement of AC voltage and current.
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2. Laptop based programmer for level transmitters: 1 no.

3. Tools & Tackles

Make	Taparia/ Everest
Tester	5 nos.
Allen key set, Size: 1.5 mm to 10 mm (one set consisting of 8 pieces)	1 set
D Spanner set, Size: 6 mm to 20 mm (one set consisting of min. 8 pieces)	1 set
Ring Spanner set, Size: 6 mm to 20 mm (one set consisting of min. 8 pieces)	1 set
Screw drivers (champion set)	1 set
Combination Pliers, Size: 6" & 8"	1 set
Nose Pliers Size: 6"	1 no.
Hammers	1 no.
Files, Size: 12" flat, 12" half round, 12" round	1 set
Slide (adjustable) wrench, Size: 8", 12", 18"	2 sets
Pipe wrench, Size: 8", 12", 18"	1 set
Wire stripper	1 no.
Cutting plier Size: 6"	2 nos.

04.09. 06 LIST OF PREFERRED MAKES

<u>PREFERRED VENDOR LIST OF INSTRUMENTATION EQUIPMENT</u>		
SL. No.	ITEM DESCRIPTION	PREFERRED MAKES
1.	<u>PRESSURE INSTRUMENTS</u>	
1.1	Pressure / Differential Pressure Gauge	1. WIKA, 2. Ashcroft, 3. Forbes Marshall 4. <i>Budenberg</i> 5. Waaree instruments, 6. Hirlekar (DP gauge)

1.2	A). Pressure / Differential Pressure switches. (Mech. Type)	<ol style="list-style-type: none"> 1. Switzer, 2. Ashcroft, 3. <i>Solon</i> 4. <i>Budenberg</i>, 5. <i>Forbes Marshall</i>
	B). Pressure / Differential Pressure switches. (Electronic Type)	<ol style="list-style-type: none"> 1. Ifm. 2. WIKA, 3. <i>Kobold</i>
1.3	Pressure / Differential Pressure Transmitters	<ol style="list-style-type: none"> 1. Emerson (Rosemount), 2. Honeywell, 3. Yokogawa, 4. Siemens, 5. ABB 6. <i>Endress & Hauser.</i>
2. <u>TEMPERATURE INSTRUMENTS/SENSORS</u>		
2.1	Temperature gauges	<ol style="list-style-type: none"> 1. WIKA, 2. Ashcroft, 3. <u><i>Budenberg</i></u> 4. Waaree instruments
2.2	Thermocouple & RTD / thermo well	<ol style="list-style-type: none"> 1. Tempsens, 2. Toshniwal Industries, 3. Detriv. 4. <i>Temptech</i>,
2.3	Temperature Switch	<ol style="list-style-type: none"> 1. WIKA, 2. Switzer 3. <i>Ifm.</i>
2.4	Temperature transmitter	<ol style="list-style-type: none"> 1. Emerson (Rosemount), 2. Yokogawa, 3. Honeywell, 4. <i>MTL</i> 5. <i>Phoenix.</i> 6. <i>Siemens</i>
2.5	Infrared radiation pyrometer/portable	<ol style="list-style-type: none"> 1. Land, 2. Ircon, 3. Raytek,

		4. <i>Impac</i> , 5. <i>Keller HCW</i>
3	<u>FLOW INSTRUMENTS</u>	
3.1	Rotameters	1. Forbes-Marshall, 2. Chemtrols, 3. Rota Instruments. 4. Eureka instruments 5. <i>SMC</i>
3.2	Orifice Plate & flanges Assembly/ Venturi, Flow nozzle	1. Engineering Specialties, 2. Micro-precision, 3. Instrumentation Ltd, 4. <i>Uni-control</i>
3.3	DP type Flow / Level Transmitters	1. Emerson (Rosemount), 2. Honeywell, 3. Yokogawa, 4. Siemens, 5. ABB 6. <i>E&H</i> ,
3.4	Flow Switch	1. Ifm. 2. <i>Kobold</i> , 3. <i>Mobrey</i> 4. <i>Sitron</i>
3.5	Electromagnetic flow meter	1. Yokogawa, 2. Emerson (Rosemount), 3. Forbes -Marshall, 4. Endress & Hauser.
3.6	Vortex Flow meter	1. Emerson (Rosemount) 2. Forbes –Marshall 3. Yokogawa 4. <i>Endress & Hauser</i>
3.7	Mass (coriolis) flow meter	1. Emerson (Rosemount) 2. Yokogawa 3. Forbes –Marshall 4. Endress & Hauser,
4	<u>LEVEL INSTRUMENTS</u>	

4.1	Level gauge (magnetic & reflex type)	<ol style="list-style-type: none"> 1. Chemtrol 2. Forbes Marshall 3. <i>Mobrey</i> 4. <i>Hi-Tech (levelstat)</i>
4.2	Level Switch (Conductivity type)	<ol style="list-style-type: none"> 1. Vega 2. Endress & Hauser 3. <i>Pepperl & Fuchs</i>
4.3	Level Switch (Capacitance/RF type)	<ol style="list-style-type: none"> 1. Vega 2. Endress & Hauser 3. <i>EIP Bulk</i> 4. <i>Sapcon</i>
4.4	Level Switch (Tuning fork/ Rod type)	<ol style="list-style-type: none"> 1. Chemtrol (Vega) 2. Endress & Hauser 3. <i>Pepperl & Fuchs</i>
4.5	Level Switch (Float type)	<ol style="list-style-type: none"> 1. Emerson 2. Forbes Marshall 3. V-Automat 4. <i>Mobrey</i>
4.6	Level Switch/ Transmitter (Displacer type)	<ol style="list-style-type: none"> 1. Emerson 2. Chemtrols (Eckard) 3. <i>Mobrey</i> 4. <i>Masoneilan</i>
4.7	Level Switch/ Transmitter (Ultrasonic type)	<ol style="list-style-type: none"> 1. Endress & Hauser 2. Forbes –Marshall 3. Siemens (Miltronics) 4. <i>Sick</i> 5. <i>Pepperl & Fuchs</i>
4.8	Level Switch/ Transmitter (Radar type)	<ol style="list-style-type: none"> 1. Emerson (Rosemount) 2. Endress & Hauser 3. Forbes- Marshall 4. <i>Sick</i> 5. <i>Mobrey</i>
4.9	Level Switch/ Transmitter (Nucleonic type)	<ol style="list-style-type: none"> 1. Concord International (Dr. Berthold) 2. Emerson (Kay Ray) 3. <u><i>E&H</i></u>
5	<u>CONTROL VALVES AND ACCESSORIES</u>	

5.1	Control valve	<ol style="list-style-type: none"> 1. Fisher-Xomox 2. Instrumentation Ltd 3. Masoneilan 4. Valflo 5. Samson Controls 6. Forbes Marshall (Arca),
5.2	Electrical Actuator	<ol style="list-style-type: none"> 1. Auma 2. Limitorque 3. Instrumentation Ltd(Bernard) 4. <i>Beck</i>
5.3	Pneumatic Actuator	<ol style="list-style-type: none"> 1. Fisher-Xomox 2. Instrumentation Ltd 3. Masoneilan, 4. Valflo 5. Samson Controls 6. Forbes Marshall (Arca)
5.5	Self- regulating pressure control valve	<ol style="list-style-type: none"> 1. Samson Controls 2. Forbes Marshall 3. Instrumentation Ltd. 4. Nirmal Industries 5. <i>Fisher-Xomox</i>
5.6	I/P converters	<ol style="list-style-type: none"> 1. Forbes Marshall (Moore products) 2. ABB 3. Emerson 4. <i>Honeywell</i>
5.7	Pneumatic Positioner,	<ol style="list-style-type: none"> 1. Instrumentation Ltd 2. Dresser Industries (Masoneilan) 3. Samson Controls 4. Forbes Marshall (Arca) 5. <u>SMC</u> 6. <i>Fisher Xomox</i>
5.8	Electro- pneumatic positioner	<ol style="list-style-type: none"> 1. Fisher-Xomox 2. Siemens 3. Masoneilan 4. Samson Controls 5. Instrumentation Ltd.

		6. Forbes Marshall (Arca) 7. ABB
5.9	Solenoid Valve	1. Herion, 2. Rotex 3. Schrader-Schovill 4. Asco 5. <i>Mac</i> 6. <i>Burkert</i>
5.10	Air filter regulator	1. Shavo-Norgren 2. Marsh-Bellofram 3. Placka 4. Schrader-Schovill.
6	<u>CABLES</u>	
6.1	Instrumentation Cable	1. Universal Cables 2. Delton 3. Lapp cables 4. Brooks Cables 5. <i>Asian cables</i> 6. <i>Belden</i> 7. <i>MEM</i>
6.2	Thermocouple Compensating Cable	1. Toshniwal Cables 2. Paramount Cables 3. Udey pyro-cables 4. Brooks 5. <i>MEM</i>
B.	<u>CONTROL ROOM INSTRUMENTATION</u>	
7.1	Distributed Control System (DCS)	1. Yokogawa (CS 3000) 2. Honeywell ((Experion +C 300) 3. Emerson (Delta-V)
7.2	Programmable Logic Controllers.	Refer Electrical
7.3	Digital Indicator	1. PEPL 2. Masibus 3. Lectrotek 4. Honeywell. 5. <i>Yokogawa</i>

		6. <i>ABB</i> 7. <i>Micro controls</i> 8. <i>Radix</i>
7.4	Bar graph Indicator	1. Masibus Instruments 2. Lectrotek 3. <i>ABB.</i> 4. <i>Yokogawa</i>
7.5	Recorders (Chart less)	1. Eurotherm 2. Yokogawa 3. Honeywell 4. <i>ABB.</i>
7.6	Microprocessor based controller	1. Yokogawa 2. Siemens 3. Honeywell 4. Eurotherm 5. Forbes Marshall 6. Toshiba
7.7	Digital scanners	1. Masibus Instruments 2. Lectrotek 3. <i>Radix</i> 4. <i>Micro Controls</i> 5. <i>PEPL</i>
7.8	DC Power Supply Unit	1. Aplab 2. Phoenix 3. Schneider 4. <i>P&F</i> 5. <i>Siemens</i>
7.9	IS Interface/Zenner Barrier	1. Pepperl & Fuchs 2. MTL 3. Stahl
7.10	Signal isolators	1. Pepperl & Fuchs 2. MTL 3. Yokogawa 4. Forbes Marshall (Protech) 5. Phoenix

7.11	Annunciation system	<ol style="list-style-type: none"> 1. IIC 2. Minilec 3. Procon 4. <i>Digicont</i> 5. <i>MTL</i> 6. <i>BETA instruments</i>
7.12	Instrument Panels/ Control Desk	<ol style="list-style-type: none"> 1. Rittal 2. Pyrotech 3. Instrumentation Ltd.
7.13	Manual loaders	<ol style="list-style-type: none"> 1. Masibus 2. PEPL 3. Lectrotek
7.14	Totalizer	<ol style="list-style-type: none"> 1. Masibus 2. PEPL 3. Lectrotek 4. Bivak

C. <u>ANALYTICAL / SPECIAL INSTRUMENTS</u>		
8.2	Gas Detectors	<ol style="list-style-type: none"> 1. Dragger 2. <i>Crowcon</i> 3. <i>MSA</i> 4. <i>BW Technologies</i> 5. <i>Reiken-Keiki Japan</i> 6. <i>Bieler & Lang</i>
8.4	Moisture Analyzers (Nucleonic)	<ol style="list-style-type: none"> 1. Concord International (Dr. Berthold) 2. Emerson (Analytical). 3. Sick 4. Thermo Electron
8.6	IR type Moisture analyzer	<ol style="list-style-type: none"> 1. Moistech 2. NDC(EMC)

8.8	<p>Vibration sensors & monitors</p> <p>A. For turbines and other high speed critical machines</p> <p>B. For other applications</p>	<p>1. Bentley Nevada</p> <p>2. <i>Shinkawa (Forbes –Marshall)</i></p> <p>1. SPM</p> <p>2. Rockwell</p> <p>3. <i>Vibro-meter</i></p> <p>4. <i>Shinkawa (Forbes –Marshall)</i></p>
8.9	Opacity/Dust concentration meter	<p>1. Codel (Forbes- Marshall)</p> <p>2. Durag</p> <p>3. Emerson</p> <p>4. Land</p> <p>5. GESensing</p> <p>6. Chemtrol</p>
8.11	SPM analyzer	<p>1. Emerson</p> <p>2. Yokogawa</p> <p>3. Durag</p> <p>4. ABB</p> <p>5. Honeywell</p> <p>6. Forbes Marshall (Codel).</p>
8.12	SOx- NOx analyzer	<p>1. Emerson</p> <p>2. Yokogawa</p> <p>3. ABB</p> <p>4. Siemens</p> <p>5. Honeywell</p> <p>6. Forbes Marshall (Codel).</p>
8.13	Moisture Sensor & Transmitter	<p>1. Invensys (Foxboro)</p> <p>2. Bartec</p> <p>3. GE-Panametrics</p>

04.10 ELECTRICAL POWER DISTRIBUTION, DRIVES, CONTROL & ILLUMINATION

04.10.01. General

This section covers major features of Power distribution System, Shop-Electrics, Drives, Control, Automation and Illumination System to be supplied by Contractor for the Coal Handling Plant (CHP) & Coke Sorting Plant (CSP), Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP).

The Contractor will refer to General Technical Specification for Electrics (GS-03) for detailed specification of equipment/components. This Contract Specification (CS), General Technical Specification (GTS) including Preferred Makes for Equipment and supplies (GS-13) and other attached documents/ Annexure E-01(Tools & Tackles), E-02(Commissioning Spares), E03, E-04, E-05 considered, as a whole will comprise the complete Contract Specification. These are complementary and anything laid down in one and not in other will be deemed as binding, as though laid down in the Contract specification as a whole. In case of conflict between the Contract specification and GTS, the Contract specification (CS) will prevail.

04.10.02. HT Power Supply System & Battery Limit

Power supply for the Coke Sorting Plant and Coal Handling Plant will be made available from the 11/6.6 kV switchboards proposed to be installed at HT substations (HTSS) near COB#11(HTSS-48), under a separate package by EMPLOYER (package no. 071).

Power supply for the Augmentation in Flux - Fuel Preparation And Plant Return Fines Handling for SP III of SP-3 Complex will be made available from the 11/6.6 kV HTSS for SP-III -HTSS-43 and HTSS-45 (beside HTSS-42) Complex under a separate package by EMPLOYER (package no. 071).

Refer typical power distribution drawing no.MEC/S/9101/11/E1/06/00/00/064.01/R1 for HTSS

The scope of work of the Contractor will commence from the outgoing terminals of 11/6.6 kV switchboard located at HTSS-48, HTSS-45 and HTSS-43 Complex for the respective facilities.

This 11/6.6 kV Switchboards at HTSS will be used to supply power to all LT substations (LTSS) and all 6.6 KV HT Motors under the scope of this package. Supply, laying and termination (at both ends) of all HT & Control Cables from HT switchboard to LTSS & HT motors will be in the

scope of Contractor. Power to all the HT motors will be supplied from the 6.6kV HT Switchboards.

Adequate number of LT Substations (LTSS), (at suitable locations to be decided by the Contractor) each comprising of LT switchboard along with two transformers will be included by the Contractor in his scope of work. The transformer rating will be worked out on the basis of guidelines given in General Technical Specification. However, the rating of transformers will be 2000/ 1000 kVA depending upon the load. The interconnection between transformer secondary and LT switchboard will be through bus ducts.

The Contractor will indicate the numbers of 11KV and 6.6 kV feeders required by them from HTSS during Basic Engineering to provide HT feeders by Employer. The Contractor will indicate the details of connected load (KW) & Maximum Demand in 15 min. duration for each feeder and also the overall expected maximum demand in 15 min duration for the entire plant under normal operating conditions.

The following are to be considered in addition to the equipment specification spelt out in GTS.

- a) The vector group for all distribution transformers (LT S/S) will be of Dyn11 only to take care of circulation of harmonic currents. However, care should be taken not to envisage mixing of supply with the existing LT power sources of 2.5 MT area as the existing distribution transformers are of Yy0 vector group.
- b) Separate analogue voltmeters for line voltage & bus voltage and ammeter in each of the three phases will be provided.
- c) All out going ACBs will be 800A, 1000A or 1600 A as per requirement with protection settings selectable at site.
- d) Check-synchronising relay will be provided wherever sectionalizing is envisaged between two different sources of power supplies.
- e) Care should be taken to avoid location of LT Substations under Conveyor galleries/ dust prone areas.
- f) LT Bus-duct insulators will be of porcelain.
- g) The CT mounting arrangement inside the cable chambers of all feeders will be such that CTs and secondary connections will be

easily accessible for maintenance, replacement, etc.

Each of the LT substations will have the following facilities:

- a) The substation design will be dust proof and all entry points will be provided with double door arrangements.
- b) Sufficient quantity of fire extinguishers at various locations will be provided as part of safety equipment inside sub-station.
- c) Air cooling facility will be provided in all LT substations with air washing.
- d) Lighting circuits of different rows will be controlled by different MCBs for better energy saving.
- e) Breaker handling facilities will be provided.
- f) Tools & tackles along with store room facilities will be provided.
- g) Two nos of 4 legged wooden stools of height 1m and 4m each will be provided.
- h) Chain pulley block or telfer arrangement will be provided.

04.10.03. Scope of Work

The scope of work of Contractor will cover design, basic and detailed engineering, submission of drawings for approval, manufacture, testing, inspection by EMPLOYER/Consultant, packing, loading, forwarding, delivery at Plant site, loading/unloading, storage, handling of material/equipment for erection, erection, no-load and load testing, commissioning, PG test, PAT/FAT and liquidating the defects and handing overall electrics related to Power Distribution, drives & control, illumination for complete & satisfactory operation of Coal Handling Plant(CHP) & Coke Sorting Plant(CSP), Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP) on Turnkey basis.

Any item or equipment not specifically mentioned but essential for proper installation, operation, maintenance and safety of plant, equipment and personnel will be included by the Contractor in his scope of work

The scope of work for this package will include but not limited to the following:

I) Power Distribution Equipment

- 1. Adequate numbers of Double ended 11/0.433 kV or 6.6/0.433 kV LT substations(LTSS)
- 2. Each double ended substation will comprise of 11/0.433 kV or 6.6/0.433 kV Distribution transformers, 415 V PCC, 415 V Bus-duct, ACDB , MLDB , LDB, HT/ LT power & control cables and other necessary items

as required for completion and successful operation of the power distribution network, in an integrated manner.

3. Vacuum circuit breaker (VCB) without protections in the transformer room if transformer is fed from **remote** HT switchboard for tripping of upstream breakers
 - Push Button stations with trip PBs (press to lock and turn to release) in the transformer room if transformer is fed from HT switchboard located in the **same building** for tripping of upstream breakers.
4. Power and control cables, Cable termination kits, laying and termination (at both ends) of all associated power and control cables from the EMPLOYER's 11/6.6 kV switchboard. Only 11kV (UE) grade cable will be used for 6.6kV (UE) applications.
5. AC distribution boards (PDB) - Single front, non draw-out type, sheet steel enclosed, modular construction with IP54 enclosure, having two incomer with a bus coupler will be provided for auxiliary equipment of LTSS.
6. Contractor to provide 2 feeders of 400A each in the CSP LTSS for EMPLOYER's use.

Construction Power Supply:

The facilities for distribution of construction power supply will be in the scope of the Contractor.

For construction power supply, one no. outgoing feeder of 415V AC, 3ph, 50 Hz will be made available at the nearest construction power sub-station by the EMPLOYER for each Coal Handling Plant, Coke Sorting Plant and additional Flux & Fuel crushing & Fines handling system respectively.

Supply, erection, testing and termination at both ends of incoming power cable to Contractor's construction power distribution board, further distribution and regular maintenance of the construction power supply network will be under the scope of Contractor

II) DRIVES, CONTROLS AND ILLUMINATION SYSTEM

1. All HT and LT AC/DC motors, actuators, brakes etc. as per technological and process requirement.
 - HT motor winding and bearings, temperature sensors, vibration sensors will be hooked up with PLC for monitoring.
 - For HT motor, surge suppressor to be installed near the motor.

- Generally Squirrel Cage Induction Motor with DOL starter / VFD / Soft Starter will be provided.
 - Suitable Rotor contactor panels and SS-grid Resistance Boxes will be provided for starting and speed control of slip ring motors wherever required as per Technological requirement.
 - All HT conveyor motors will be S1 duty.
 - All LT motors for conveyors will be S6 duty and will have class F insulation with temperature rise limited to class B.
 - Inverter duty motors (used for VFD application) will have class H insulation with temperature rise limited to class F.
2. Indoor 415 V LT MCC and Control panel with CT, PT, metering and Protection etc. as required.
- Motor Control Centres for Coal Handling Plant and Coke Sorting Plant area will be Intelligent, draw out type with two incomers and bus coupler for control of drives of rating up to 90kW, of various technological units having communication with Plant Automation System.
 - Motor Control Centres for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be Conventional, drawout type with two incomers and bus coupler for control of drives of rating up to 90kW, of various technological units.
 - For control of drives of rating from 110kW to 200kW of various technological units, Intelligent type Motor control panels (MCPs) for CHP, CSP and FFP area having communication with Plant Automation System.
 - Control panel for Tripper car, crane, hoist, small machines and Auxiliaries will be conventional type, non draw-out control panel. All control panels on the mobile machines will be mounted on anti vibration pad.
 - Electronic over load relay for motors upto 90kW and Motor Protection Relays for motors above 90 kW will be used in conventional type (non-intelligent) MCC / Control panel. The electronic overload relay will be of Manual Reset type.
 - Local/Remote selector switch will be mounted on MCC & Control Panel.
 - Motor feeders up to 45 kW rating will have MPCB and MCCB beyond 45 KW rating.
 - Current monitoring for all drives of rating above 30kW
 - Conveyors feeding to Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP) C7-3.5KW, C1-30KW & C2-45KW will be fed from new MCC under the scope of package. Contractor will consider Power cable for feeding the same. These Conveyors will be connected and controlled by new PLC envisaged

in this package of FFP. Suitable control cable and other accessories will be considered.

3. VVVF converters :

- VVVF converters for 415 V motor drives having requirement of speed control where process requirement calls for variable speed application. All drives will have communication capability with Plant Automation System.
- VVVF Converter having communication capability as above at medium voltage (like 690 V) complete with 3 winding Converter transformer (for 12 pulse configuration) & incoming ACBs for higher rated motors.
- VFD will have following features:
 - Minimum rating of AC drives and reactors will be 150% of the full load current of the motor.
 - Automatic disconnection of individual Motor in case of failure of AC drive.
 - Use of isolation transformer for more than 90 KW drive and use of series reactor for less than 90 KW drive for VFD application.

4. Soft Starter :

- All HT Motors for conveyor drives will be provided with Flux Compensated Magnetic Amplifier (FCMA) Soft starter for low starting current. FCMA soft starter will have suitable By-pass contactors and controls to ensure running of the motor at full speed. FCMA soft starter will be indoor duty, rugged in construction, user friendly and maintenance free.
- FCMA Soft starter for HT conveyor motors will be connected to motor at neutral end with suitable enclosure to prevent the dust entry.
- Soft starter will be provided for LT motors of rating more than 75kW.

5. Dual parallel redundant UPS system consisting of SMF battery bank for 30 minute back up incase of power failure, Battery charger, UPS Power distribution boards & sub-distribution boards for distribution of UPS power supply to control & Automation equipments, Instrumentation system equipment, FDA system, Weighing system & any other equipment as per requirements.

6. Local control stations housing push buttons, indication lamps etc. for all drive. LCS for HT motor will have Ammeter also. All Local control stations will have double doors. LCS for conveyors will have belt sway switch bypass. Local/Remote selector switch will be mounted on MCC & Control Panel and not on LCS.

7. Power distribution boards (PDB) with two incomers and one bus

coupler for repair network like welding sockets, maintenance cranes and hoists. All PDBs to be mounted in Technological/Auxiliary/Service buildings (Other than Electrical room) will have double doors. Enclosure Class will be IP54.

8. Main Lighting Distribution Boards (MLDB) with two incomers and one bus coupler for Power supply to various Lighting distribution Boards (LDB). Enclosure Class of MLDB & LDB will be IP54.
Adequate nos. of LDBs and Sub Lighting distribution boards for providing power to light fittings.
9. Emergency lighting distribution boards (ELDBs) with two incomers and one bus coupler for Power supply to various Emergency Sub Lighting distribution Boards (ESLDBs) and feeding arrangement will be as per GTS.
Adequate nos. of Emergency Sub Lighting Distribution Boards (ESLDBs) for providing power to emergency light as given below :
 - 20% Emergency lighting in all Junction houses, Process / technological buildings, pump houses, compressor houses, conveyor tunnels, underground premises, LTSS, Despatcher / Control rooms, staircases, entry / exit of building, office rooms, attendant / operators rooms, shift in charge rooms, canteen / rest rooms etc.
 - 10% Emergency lighting in conveyor galleries.
10. Exit light from UPS distribution board for the following areas :
 - LTSSs / Electrical premises.
 - Dispatcher / Control rooms.
11. Portable Emergency lights will also be provided in strategic areas like LTSSs, Electrical premises, control rooms, staircases, entrance of cable tunnels / basements, escape routes, attendant / operators room in the technological buildings etc.
12. DCEM Brakes with economizing resistance will be used for Conveyors and brake panels will be housed in MCC room.
A Brake panel will not feed power to more than 2 nos. of brakes.
13. Surge protection device will be provided at the incoming side of MCCs, VFDs, Soft starters, PLCs/Remote I/O stations etc. to protect the system/equipment as required.
14. All field devices, valves, safety switches like Pull chord switches and belt sway switches, zero speed switch, chute jamming switches and Proximity switches, Warning hooters, level sensors, relays, limit switches, isolators, speed sensors etc. as necessary for the process and control of the material handling equipment / system and its all associated / auxiliary equipment / systems.

- Addressable type PCS, Addressable type BSS, ZSS and Belt rupture protection switches will be provided for all new and existing conveyors being upgraded.
 - Proximity type Limit switches will be used for shuttle conveyors, tripper car etc.
 - Sensing distance of proximity in the Zero Speed Switch will be 60 mm.
 - RF admittance type chute clogging switches flush with chute body will be provided.
 - Infrared type Belt rupture protection switches will be provided in all conveyors. The minimum set of belt rupture switches will be provided as given below :
 - 1 set for conveyors of length up to 50m.
 - 2 sets for conveyors of length above 50m and below 100m.
 - 3 sets for conveyors of length above 100m.
 - Chute Jamming switches in all chute including chute in Tripper Car.
15. All HT/LT Power, control, signal, communication cables (fiber optic / electrical), special cables, rubber insulated flexible cables, illumination cables etc. as required.
 - All HT and LT Power cables will be XLPE insulated.
 - All HT Power cables will be 11kV UE grade and FRLS sheathed.
 - LT Control cables will be PVC insulated.
 - Minimum size of Control cables will be 2.5 sq. mm.
 - Copper cable will be used for imported motors, crane and moving equipment.
 16. 415V, 100A interlocked switch socket outlets for repair network, welding sockets at different floor, premises, buildings and other areas. Maximum 3 nos. Welding sockets will be connected to one feeder with 100Amp MCCB rating & minimum size of cable will be 3.5 x 70sqmm.
 17. 240V, 15A and 24V, 5A receptacles from Lighting Distribution Board / Sub Lighting Distribution Board.
 18. Load break isolators for maintenance crane, hoists, tripper car etc. to be located near the equipment.
 19. Power and control junction boxes will be made up of SS sheet with weatherproof enclosure for termination of field cables.
 20. Power trolley line conductor (DSL) / Festoon Cable trolley system / Plastic Cable Carriage system including rails / angles, supporting brackets, insulator assembly, junction box etc. will be provided as follows :
 - Festoon Cable trolley system for hoists etc.
 - Plastic Cable Carriage system for power and control trailing

cables for shuttle conveyors, EOT cranes etc.

21. Cable Reeling Drum with stall torque induction motor will be provided for Tripper Car.

Tripper car will have interlocking of chute clogging switch with conveyor through wireless radio communication. Interlocking with the CRD control cable will be given as back-up.

22. Illumination of the plant covering new storage yard, outdoor area lighting, peripheral lighting, coal tower top, shuttle conveyor floor, Road in and around the proposed units, Sub- stations, MCC rooms, Control rooms, Ventilation rooms, conveyors, Junction houses, various technological / auxiliary buildings and other installations of the plant by providing Lighting Transformer, Main Lighting Distribution Board, Lighting Distribution Boards, Sub-lighting Distribution Boards, Feeder pillars, Light Fittings, Lighting towers, high mast, low voltage switch sockets, conduits, Ceiling fans, Exhaust Fans, all lighting cables etc.

New plant lighting system will comprise of the following categories of lighting system.

- Normal /240V AC lighting system.
- 24V AC maintenance lighting system.
- Emergency lighting system.

23. Illumination, AC, Ventilation, 240V, 5A/ 15A sockets, Exhaust fan for toilet etc. for office building etc.
24. Complete electrics including motors, control panel, LCS, Brakes with panel, field devices, cables etc. for Conveyors, Screens, Actuators, valves, gates, vibro feeders, belt feeders etc. as required.
25. Complete electrics including motors, control panel, LCS, Brakes with panel, field devices, cables etc. for Shuttle conveyors, Tripper cars, Cranes, Hoists etc.
26. Complete electrics and load cell for Weigh feeders, Weigh hoppers, Belt scales etc. as required.
27. Complete electrics required for Suspended magnets, In Line Magnetic Separators, Metal presence detectors etc.
28. Complete electrics, controls, instruments, level controllers, solenoid valves, Bag filters, Timer controls etc. for the Dust suppression system, Dust extraction system, Ventilation, Air Conditioning system as required.
29. Completes electrics including motors, control panel, LCS, level sensors, cables etc. for sump pumps, slurry and dewatering pumps will

be provided in underground floor of technological building/ Junction houses, Tunnels, cellar etc.
415V, 100A Sockets will also be provided near sumps.

30. Completes electrics including motors, control panel, LCS, level sensors, cables etc. for all pump houses, fire fighting system etc.
31. Complete electrics for Bin vibrators with rectifier panels and Air Blaster with solenoids, control panels, cables etc. for Bunkers as required.
32. Complete electrics for sampling systems covering motors, control panels, cables LCS etc.
33. Complete electrics for all Crushers including the followings :
 - Motors for main and auxiliary drives with necessary accessories and brakes as required.
 - Rotor contactor panels, Resistance boxes for Slip ring motors / VFD or DOL or Soft starter for Squirrel Cage motors as required.
 - Control Panel, Local control stations, field devices, safety devices, Limit switches, speed relays, solenoids, Power & Control Junction Boxes etc. as required.
 - Power and control panel for roll grinding attachment including drive motors for roll crusher.
 - Control panel for hydraulic and lubrication system including drive motors as required.
 - All power, control and special / instrument cables etc.
 - Earthing.
 - Hammer crusher will have local control station in which necessary Push buttons, Ammeter, Temperature Monitoring facility, indication lamp, hooter etc. will be provided to operate locally as well as from control desk.
 - Hammer crusher will be operated from Local Control Post. Apart from LCS, Local Control Post will be provided which will be kept in same crusher building. AC for Local Control Post will be provided. Extensive monitoring of HT drive will be done from Local Control Post and the information will be sent to Dispatcher for monitoring.
34. All LCS for outdoor application will be made of SS sheet. All control Push Button will be covered with Silicon Rubber Boot to prevent dust ingress.
35. Scope of work and Battery limit for Electrics and Automation for up gradation, modification, integration of existing drives / mechanism is defined in the **Clause No. 04.10.11.**
36. Automation system:
 - a) PLC based Automation system of proposed Coal Handling Plant

Pkg-064, will be interfaced with Automation system of Coal Transportation Plant (Pkg-062) being arranged by the EMPLOYER through a separate package (as indicated in Automation Configuration Drawing enclosed) so that entire coal transportation from silos to all coal towers can be operated in an integrated way from a common despatcher / control room D2 (under EMPLOYER's scope). The PLC based Level-1 automation system of CHP will be provided as mentioned in the automation chapter.

- b) PLC based Level-1 automation system of proposed Coke Sorting Plant will be provided as mentioned in the automation chapter for running the new Coke Sorting Plant from a new control room/ despatcher under the scope of Contract.
 - c) PLC based Level-1 automation system of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III which will be connected to existing PLC through suitable gateway. The new PLC & HMIs will be housed in existing Control Room 1(CR-1).The existing HMIs will suitably be upgraded to match the new HMIs for operation of the entire existing and new FFCS plant.
37. Contractor to provide following feeders for EMPLOYER's use in Electrical Premises near Coke Dedusting unit of Coke Sorting Plant:
- 2 no. feeders of 100A each in MLDB/LDB.
 - 2 nos. of power supply feeder of 100A each in PDB.
38. CCTV camera with cleaning facility will be provided in the following tentative locations with monitors at Despatcher / Control room for extensive monitoring of given below areas:
- a) Coke Sorting Plant.**
 - 2 Nos. for Coke storage area.
 - 2 Nos. at Coke Screening Station.
 - 2 Nos. at Coke Crushing Station
 - b) Coal Handling Plant**
 - 2 nos. for new silos
 - 2 nos. at New Coal Tower no.-7
- Final location will be decided during detailed engineering.
39. Electrical equipment will be supplied as per the Make list given in GTS (GS-13). However, in case of non-availability or delay in delivery, the Contractor will take prior approval of BSP/MECON for additional make before ordering. Make of Plastic Cable Carrier system will be IGUS / Kable Schlepp.

III) Control Rooms, Electrical Premises, Ventilation, Air-Conditioning & FDA System

1. All civil construction work for cable basement/cellar, cable tunnel and

concrete cable trenches, MCC Rooms, Despatchers/Control rooms, Electrical premises etc. including their associated utility areas like Ventilation rooms, Stairs, Toilet etc.

2. Control for the proposed Coal Handling Plant will be from Despatcher (D2) building being arranged by EMPLOYER under separate package (62). The Contractor will furnish space requirement and assignment to the EMPLOYER for making the provision in the Despatcher-D2.
3. Control of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be done from existing Control Room 1(CR-1). Necessary modification, if required for laying of cables and mounting equipment in the existing control room, the same will be provided by the Contactor.
4. Control of Coke Sorting Plant will be done from a new control room/ despatcher under the scope of Contract.
5. Cable Tunnels / Structures for overhead cable bridge as required.
6. Intelligent, microprocessor based, addressable type automatic fire detection and alarm system for all MCC rooms, Electrical Premises, Cable cellar, Despatcher cum Control room using smoke detectors, heat detectors with cross zoning.
7. Air conditioning system for Control rooms cum Despatchers (housing Operator control/HMIs, Servers, Engg. stations, Instrument panels, UPS etc).
8. Air conditioning system at (35 deg C max.) for premises housing Intelligent MCCs, MCPs & VVVF panel rooms and other local control rooms complete with instruments, electrics, controls etc.
9. Ventilation system for substation building, Cable tunnels, Cable basement / cellar consisting of suitable capacity fan, Pumps, GI ducting etc.
10. Exhaust ventilation system for toilets, storerooms, Battery rooms etc.
11. Excavation, back filling, and leveling of cable trenches within battery limits.
12. Cable cellar for all Electrical premises/ LTSS/ MCC room etc.
13. MCC room and LTSS can be combined building with a separation wall and with a door for interconnection .
14. Cable supporting structures in the Electrical Premises, Despatchers /

control rooms, cable cellars, cable tunnel, cable channel or overhead cable bridge for interplant cabling.

15. The tentative location of LTSS: **CHP** –LTSS opposite 5 silos, **CSP**-LTSS near JH-11 and Coke Screening station and **FFP**-LTSS near JH-117 and Coke breeze storage yard. If the nos. of LTSSs increases during Basic Engineering to suit the technological requirement in line with GTS, the same will be proposed by Contractor during Basic Engineering.

IV) Earthing and Lightning Protection

1. Measurement of soil resistivity test at site for designing earthing system.
2. Lightning protection system for entire plant including Air termination, separate dedicated earthing stations, conductors, testing links, interconnections and accessories as per IS.
3. Supply and installation of complete earthing system including earth pits, earth grid with GI strips for the substations, neutral earthing of transformers, earthing of all electrical equipments in electrical premises, Junction houses, process / technological building etc.
4. Special earthing system (including earth pits, earth grid with GI strips, Copper Cables as required) for earthing of PLC, RIO panels, VFD, other Electronics equipment & automation system as per their manufacturer's recommendation. It will be distinct and separate from the power and lightning equipment earthing system.

V) Erection accessories, spares, safety items, documentation & other miscellaneous items

1. Supply of all erection accessories and materials, all steel members (angle, channel, plate, steel sheet, etc.) for installation of electrical equipment, GI pipes, GI conduits, bends, clamps, nut, bolts, ladder and perforated type cable trays, tray installation materials & accessories, cable supporting structures, heat protection materials, flexible metallic hoses, sealing materials for openings/conduits, double compression cable glands, cable lugs, cable tags, cable fasteners, insulating tapes, ferrules, RCC slabs, sand, bricks for under ground cable laying, GI pipes for protection of cables at road crossings and other places, cable markers, cable jointing & termination kits and materials, earthing strips of different sizes, junction boxes, pull boxes, heat resistance paints and all consumable materials for complete laying & termination of cables, erection of electrical equipment and earthing system etc.

2. Arranging construction power supply including PDB, power (both incoming and outgoing) and control cables, cable trays, cable laying etc.
3. Submission of basic and detailed engineering drawings, design calculations etc.
4. Supply of As-built drawings, operation and maintenance manuals. CD in duplicate and reproducible of all As built drawings.
5. Supply of all commissioning spares as required till the plant is commissioned and handed over to BSP. List of minimum commissioning spares will be supplied as per attached Annexure E-02.
6. List of two years Maintenance / operational spares will be finalized during detailed engineering stage.
7. Supply of Special tools & tackles, measuring instruments etc. as per Annexure - E-01.
8. Canopy of all outdoor electrical equipment, if any.
9. First fill of all consumables, printers, papers, cartridges, floppy, CDs etc.
10. Safety items like hand gloves, shock treatment charts, discharge rods, rubber mats (of required voltage classes) in front and rear of all panels, danger/caution boards, fire extinguishers, fire sand buckets, nicely framed As built Single Line Diagram of LTPCCs, MCCs, PDBs, MLDBs, LDBs, SLDBs keys and key boxes etc.
11. Supply and installation of GI pipes for protection of cables at road crossings and other places where cables may be subjected to mechanical stress and damage.
12. Supply and installation of cable supporting structures in the LT substation building, cable cellars, cable tunnel, cable channel or overhead cable bridge for interplant cable routing.
13. Walkable Cable Bridge between EMPLOYERs's HT Substations to Contractor's LTSSs and further for routing outgoing cables to different consumers / buildings etc. as required.
14. Intershop outdoor cable route will be through only walkable Overhead Cable Bridge/ conveyor gallery/ cable tunnel. No underground buried cable will be provided. Concrete cable trench covered with pre cast slab is accepted only in covered shed or indoor area.

15. Cables of one area/conveying route will not cross and will not be laid through conveyor of other area/conveying route.
16. Minimum 1 No. electrical area repair shop (Min. size –18M X9M X 6M) in Coke Sorting Plant will be considered with a facility of rest room, repair area, store, provision to keep tools and tackles, measuring instruments/testing instrument including megger, clamp tester, hand held tachometer, CRO, multimeter, vibrometer etc.
17. Furniture for the monitor, control rooms etc.
18. Training of EMPLOYER's engineers at manufacturer's works/training centers for Automation system, UPS system, AC drives, Weighing system etc.
19. Any additional items/equipment which is necessary for achieving specified performance and completeness of the system will be provided by the Contractor within the time schedule unless it has been excluded from the scope of the Contractor.

04.10.04. Approval of Statutory Authorities

The Contractor will obtain necessary approval of statutory authority as per rules of State Government and Central Electricity Authority for the work under his scope, before energizing/charging the equipment. However, EMPLOYER will extend all assistance in this regard, like submission of application, relevant documents and payment of statutory fees etc.

04.10.05. Installation

For installation work at site, the contractor will be fully responsible for arranging the required tools and tackles, welding sets, pipe bending machine, cable crimping tools, gauges, scaffoldings, ladders, temporary water and power connections.

On completion of the installation but before energisation of the system, all installation will be physically checked and properly tested. These checks and tests will be conducted by the contractor under the supervision of BSP / MECON. The contractor will furnish the final status and test results. Any defect observed during such check and tests will be rectified by the contractor free of cost within contract completion period.

All clamps brackets, bolts, nuts, screws, markers, ferrules, lugs and glands and other hardware necessary for erection work, will be included in the scope of work and will be arranged by the contractor. Equipment will be painted to withstand the heavily polluted and saline environment prevailing in at site.

04.10.06. Design basis for equipments & installations

Ambient conditions of shop units

Generally following ambient temperature will be considered in Electrical / Control Rooms.

S.N.	Area	Ambient Temp
A.	Electrical Rooms	
1.	LT Sub-station/ switchgear room (Pressurized ventilation)	+ 45 Deg. C
2.	MCC rooms (housing intelligent MCCs, VFD panels, TR controllers, RI/Os etc.)	+ 35 Deg. C
3.	Cable basements / tunnels	+ 50 Deg. C
B.	Control Rooms	
1.	Control rooms – Air conditioned	+ 24 Deg. C

- Equipment selection and derating will generally be based on ambient temperature of + 50 Deg.C. For specific areas and shops, the ambient temperature conditions indicated above will be taken into consideration and equipment suitably derated wherever necessary.
- Equipment installed in MCC rooms/Control rooms will be designed for + 50 deg C so that in case of failure of Air-conditioning/ventilation facilities also the equipment should not be affected.
- The equipment offered should be suitable for smooth, efficient and trouble free service in the tropical humid climate prevailing at plant site and under the ambient temperature conditions indicated above for the different shops and areas. In hot areas of higher temperature conditions, the equipment will be adequately protected against damage from radiant heat and hot air.
- The equipment will be designed to give efficient and reliable performance under heavy steel mill conditions and will be such that the risks of accidental short-circuit due to animals, rodents and vermin are obviated.
- The quantities of equipment, cables, cable terminations, straight through joints, cable supporting structures, earthing / lightning and erection materials, will be as per actual requirement in accordance with the approved detail engineering drawings.

- All equipment will strictly conform to the General Specification, except where any deviations have been explicitly spelt out, specifically discussed and mutually agreed upon between the Contractor and the EMPLOYER.
- The detailed specification and schedule of quantities will be worked out based on the detailed engineering to be carried out by the Contractor, for complete and proper execution of the specified tasks.
- The final ratings of the circuit breakers, CTs, busbars will be adequate for the actual loads and considering the derating factors as substantiated by temperature rise test on the 415 V switchboards. All CT ratios / VA burdens, ranges of meters and instruments, types of relays and relay setting ranges will be submitted for EMPLOYER's approval during detail engineering.
- All HT cables will be 11 kV (UE) grade of size 3x185 sq mm (min).

04.10.07. Design basis for electrical premises for the proposed units

GTS is to be referred for designing of electrical premises & layouts, selection of equipment and installation. In addition to this, following points will be considered.

- Motor Control Centre (MCC), RIO stations, PDB, MLDB etc. to be installed in various MCC rooms, will be provided near various shop/technological units.
- Wherever required, MCC rooms and LT substation rooms (including rooms for distribution transformers) can be combined with separation wall and independent entry for both LTSS and MCC rooms considering the location of Substation and shop unit. Each LTSS building will have store facility.
- No under ground cable basement to be provided below MCC buildings.
- PLC, CPU panels, Operator panel / HMIs, Engg stations, UPS, UPS battery will be located in the air-conditioned room in the control room floor.
- For high rise buildings structural walkway will be provided for maintenance of light fittings.

04.10.08. Design Basis for Illumination System

GTS is to be referred for designing of Illumination System, selection of equipment and installation. In addition to this, following points will be considered.

- Illumination levels of all units will be as indicated elsewhere in this specification.
- The maintenance factor for design of illumination level will be considered as 0.6 for all areas.
- For arriving at utilization factor, manufacturer's recommendation will be followed.
- All rooms with false ceilings will be provided with recessed type decorative mirror optics fittings.
- All MCC Rooms will have lighting switches near doors.
- All decorative type fittings will be mirror optics type.
- All buildings will be provided with peripheral lighting.
- The power factor of lighting system will be improved to 0.9 by providing in built capacitors with individual light fittings.
- Area, outdoor and peripheral lighting will be fed from separate LDB/SLDBs having two modes of control - AUTO and Manual. Under AUTO mode lights will be automatically switched ON/OFF through 24Hrs Timer & Contactor where as in Manual mode, lights will be switched ON/OFF through local control station located in Despatcher/Control room. Selector switch for mode of control will be located on local control station.
- Lighting in conveyor gallery and junction houses (floors above ground) will be connected to separate lighting circuit and the same will be switched ON/OFF by PLC based control from HMI at Despatcher.
- Area lighting, wherever applicable, will be provided through 400W, HPSV flood light fittings mounted on lighting towers.
- Road lighting will be provided with 250W HPSV street light fittings.
- All the offices will be provided with ceiling fans.
- For indoor lighting, outgoing feeders in MCB DBs will be 20A SPN MCBs. Each feeder will not be loaded more than 2 kW. Incomer to MCB DB will be suitably rated heavy-duty switch and ELCB for detection of leakage current.
- For area and road lighting, 3 phase & neutral feeders may be used and accordingly suitably rated 4 core cables may be provided.

- HPSV lamp fittings will be provided with external electronic igniters and a built in sensor to sense failure of lamp and switch off igniters.
- Single phase/three phase circuits are connected to RYB phase such that total connected load to each phase equal and phase balancing is achieved.
- Stroboscopic effect will be corrected by providing power factor improvement capacitor and power phase distribution.
- Point wiring will be done through PVC insulated PVC sheathed Copper cable.
- Single phase 3 pin 230V, 15A and 5A, switch-socket outlets will be provided with interlocked switches (male and female units) at the following locations:
 - o At each floor of building at every 30 m intervals or minimum one for each row/side.
 - o Two numbers each in switch gear room, cable basement, control room and MCC room.
- Group control and sectorial control will be envisaged through MCBs provided in the respective LDBS. Separate control switches will be envisaged for light points and fan points.
- Near every chute in Junction houses and other technological buildings sufficient no. of 24V, 5A sockets will be provided for maintenance lighting by hand lamp.

04.10.09. Cable Routes, Cables

Contractor will note the following requirements.

Sl. No.	Requirement	Remarks
1.	EMPLOYERS's HT Substations to Contractor's LTSSs	Walkable Cable Bridge
2.	Inter shop cable routing	Through walkable overhead cable bridge/ structure/Cable Tunnel/ Conveyor gallery. No underground buried cable will be provided. Concrete cable trench covered with pre cast slab is accepted only in covered shed or indoor area.
3.	Bottom most level of cable trench in MCC room	Above ground level

04.10.10. Control and Operational Requirement:

1. All the necessary controls, interlocks and annunciation as required for smooth, efficient and safe operation of the plant will be provided.
2. Contractor will provide suitable PLC based automation system including all hardwares and softwares to run the existing and new material handling plant in an integrated manner.
 - a) PLC based Automation system of proposed Coal Handling Plant Pkg-064, will be interfaced with Automation system of Coal Transportation Plant being arranged by the EMPLOYER through a separate package (Pkg-062) (as indicated in Automation Configuration Drawing enclosed) so that coal transportation from silos to coal tower can be operated in an integrated way from a common despatcher / control room. The PLC based Level-1 automation system of CHP will be provided as mentioned in the automation chapter.
 - b) PLC based Level-1 automation system will be provided as mentioned in the automation chapter for running the new Coke Sorting Plant from a new control room/ despatcher which is to be provided by the Contractor.
 - c) PLC based Level-1 automation system will be provided as mentioned in the automation chapter for running the Flux - Fuel Preparation and Plant Return Fines Handling for SP III from a existing Control room CR-1 as indicated in the automation configuration diagram.
3. All HT drives will be provided with extensive monitoring facilities for fault detection and alarm annunciation. Alarm annunciation will be provided for over winding temperature, over bearing temperature, overload etc.
4. Alarm annunciation system will cover all the equipment of the electrical system.
5. Mode of control :
 - i) Plant will have four modes of control.
 - Local de-interlock mode for control of individual drive motor from local push button station (LCS).
 - Local interlock mode for running the drive motor in sequence interlock mode from LCS.
 - REMOTE interlocked individual drive control from the HMI at Dispatcher/ Control room.

- REMOTE interlocked route wise control of conveying system from the HMI at Dispatcher/ Control room.
- ii) Mechanism selector switch for selection of above modes of operation of each drive motor will be provided in the MCC / Control Panel / MCP. A selector switch box will be provided near respective Remote I/O station for HT motors. Local selection of any drive will be shown on the HMI screen with some sort of caution.
- iii) The local de-interlock mode is meant for testing and maintenance purpose only. However, all safety interlocks (Pull Chord Switches, motor Over Load & emergency stop etc.) will be connected in LOCAL de-interlock mode of operation. In local de-interlock mode the mechanism is not interlocked with other drive and after receive of permission from operator / PLC drive/equipment can be started from LCS independently.

The stop P.B. of local control station will be able to stop the drive mechanism selected for any mode of control. Hooter PB will be provided in LCS for pre start warning.

- iv) In Local interlock mode the drive / equipment can be run in sequence interlock from LCS. Selector switch will be put in local interlocked position and permission from operator / PLC will be a condition for operation in this mode. Start, stop, motor Over Load, emergency stop, Pull Chord and Belt Sway Switches, Zero Speed Switch, chute jamming switches will be connected in the circuit in addition to sequence interlock with successive drives. All the above will be connected through hardwire.
- v) In Remote interlocked individual mode of control the drives/mechanisms in the material flow path will be started in succession sequentially opposite to direction of material movement from operating station / HMI. On tripping of any conveyor/drive/mechanism, all the mechanisms feeding to the affected (tripped) mechanisms will stop according to material flow diagram. All the mechanism selector switches of the selected material flow path will be set to REMOTE position in this case. Programmable Logic controller will be used for the control, interlocking, operation, and monitoring of the equipment.
- vi) In Remote interlocked Route-wise control, following operations is to be carried out from HMI by the operator before starting of a conveying route:
 - a) Selection of material flow path including source and destination as per requirement.
 - b) Selection of mechanisms within the selected material flow path.
 - c) Selection of switching devices, flap gate etc. in a conveying route

- d) Selection of control mode in REMOTE of master selector switch for each material flow path block chain.

On receiving start permissive signal from HMI, the operator will give ON command to start the desired conveying route.

- vii) Normal stop and Emergency stop of mechanism for each material flow path, P.B, switches for pre-start warning signal for each material flow path, start & stop P.B. switches of drives with independent operation etc. will also be mounted on desk/ HMI.
- viii) A pre-start audio warning signal through hooters will be given in the premises where the mechanisms are to be started before start of the mechanism. The duration of the pre-start audio signal will be as per requirement. Sequential start of the mechanism will be possible only after the pre-start audio signal is over.
- ix) The conveying system will be integrated with the associated auxiliary / other system for interlocking, sequencing and monitoring.
- x) Stopping of mechanisms:
 - a) For regular stop, the feeding equipment will be stopped first to stop the material flow in the conveying path and then after some time delay the equipment in the route will be stopped in sequence from feeding end ensuring no material is in the conveying path.
 - b) Emergency stop push button will be provided on the Control desk for emergency stop of material flow path.
 - c) In case of tripping due to fault of any drive, the part of the conveying route before the faulty drive will stop. There will have signaling of the stopped mechanisms by changing color in the graphic. This will give an indication of the fault.

6. Signaling:

- A) Status of ON, OFF, Trip/Fault, Route selection etc. for all mechanisms of conveying system, dedusting system, dust suppression system, weigh feeder etc. will be available in the operator work station.
- B) When a drive in a conveying route is shifted to local controls, indication will be available in the HMI.
- C) The annunciation will be provided on HMI for each drive fault and actuation of safety and limit switches.
 - a) Annunciation for O/L & fault of each drive motor.
 - b) Individual annunciation for all HT motors trip due to high

- bearings and winding temperature.
 - c) Combined fault HT switch gear for Each HT motor including power supply to MPR failure separately.
 - e) Switching devices, flaps etc failed to close or open.
 - f) Individual annunciation for HT motors bearings and winding temperature high alarm.
 - g) Individual annunciation for following conditions of electrical system:
 - 11KV and 6.6 kV switchgear trouble
 - 415 switchgear trouble
 - Transformer trouble alarm.
 - Combined fault/trouble in bag filter system of D.E
 - Unhealthiness of various machines
 - Any other failures
 - h) Every unplanned stoppage or abnormal condition will be brought to the notice of operator.
7. Current readings of all HT and LT motors connected to Intelligent MCC will be available in HMI at Dispatcher. Current monitoring for drives of rating above 30KW.
8. Drainage/sump/slurry pump will be provided with Auto/Local mode of operation. Under automatic mode of operation any one of the pump motors will start automatically at set level and if the level rises further the second/ reserve pump will start automatically at second set level and both the pumps will stop at set low level. If the first pump trips, second pump will start automatically. Emergency high level annunciation will be available in the control room.
- Under local mode of operation, the pump motors will start/stop locally through local control boxes depending on level.
- 9 For fire fighting system, suitable control system will be provided for main fire water pump, jockey pump, hydro pneumatic tank etc. with line pressure switch.

04.10.11. ELECTRICS AND AUTOMATION FOR EXISTING DRIVES

Scope of work for Electrics and Automation for up gradation, modification and integration of existing conveyors to be upgraded as per technological requirements and will consist of Complete new MCC, PLC, field switches, LCS, Power and control cables and New Brake panel and associated cables.

Gallery lighting of existing conveyors under up-gradation will be in the scope of Contractor. Dismantling of the existing light fittings, cables etc. will also be under the scope of the Contractor.

Contractor will provide new PLC based automation system for new and

existing drives (to be upgraded as per technological requirements) for integrated operation of the overall CHP, CSP, and FFP with respective existing/new units as shown in configuration diagram and elsewhere.

The approval / clearance of BSP / their representative will be taken before carrying out new installation for up gradation for existing conveyors / equipment.

For the EMPLOYER's approval / clearance, Contractor will submit detailed shut down plan of the existing drives indicating temporary arrangement to be made by the Contractor for running suitable alternative conveying routes so that plant can maintain production level.

In the temporary arrangement in case any electrics is required, the same will be provided by the Contractor without any price implication.

Scope of work:

- Except MCC, Contractor will dismantle existing motor, LCS, safety and limit switches, associated power and control cables, Jn. Boxes, earth wire, GI strip etc. related to the particular drives. The same will be removed from site to facilitate new installation as per requirement of TS and GTS and for running the equipment.
- Contractor will provide complete new electrics including motor, suitable intelligent type motor feeder in MCCs/MCPs, brake panels, all safety and limit switches, local control station (LCS), Junction boxes, necessary hardware and software for PLC based automation (including power supply, input, output and communication cards etc.) all power, control and signal cables, earthing.

04.10.12. ELECTRICALS AND AUTOMATION FOR ADDITIONAL FLUX AND FUEL CRUSHING AND FINES HANDLING SYSTEM

All the equipments for this facility will be new.

04.10.13. TECHNICAL SPECIFICATION

04.10.13.01. General

GTS will be referred for technical specification of various electrical equipment. However for specific application following TS will be considered.

04.10.13.02. Non intelligent type Control Panel

01. Control panel for Tripper car, crane, hoist and small machine will have conventional non draw-out type and mounted on anti vibration

pad. Weatherproof enclosures will be used for outdoor control panels.

02. Constructional Features

- Non-Draw out type.
- All other features will be similar to Intelligent type indicated in GTS

03 Incoming Feeder

The incoming feeder will have:

- MCCB
- Ammeter and voltmeter with selector switch.
- 3 nos. current transformers
- 3 nos. indicating LED type lamps (R, Y, B)
- 3 nos. indicating LED type lamps (ON, OFF, TRIP)

04 Outgoing Feeders

Each outgoing motor feeder will have following:

- MCCB (above 45 kW motor) / Motor Protection Circuit Breaker (up to 45 kW motor)
- Three pole contactor
- Ammeter with CT & Selector switch.
- Stop & Test Push Buttons
- ON/ OFF/ Trip indication LEDs
- Digital microprocessor based overload relay with SPP & manual reset facility
- Motor Protection Relays for motors above 90 kW rating.

Each outgoing non motor feeders will have following:

- MCCB.
- ON/OFF indication LEDs.

05 All motors will be operable from Control desk, pendant or LCS. Only the facilities for testing the control circuit by-passing the power circuit will be provided.

06 Two number of DC power pack feeders complete in all respects with change over scheme will be provided for DC power supply to solenoid valves etc as required.

07. Ammeters for essential drive motors will be provided.

08. Major components will conform to General Technical Specification (GTS).

04.10.13.03. Motorized Damper, Switching Device, Slide Valve, Diverter Gate, Flap Gate Etc.

- 01 The motor will be 3 phase squirrel cage TEFC class F insulated (temperature rise limited to 70 deg. C. over an ambient of 50 deg. C), IP-55 enclosure both for motor switches & its terminal box, and with high starting torque and high stalling torque. The duty cycle will be S2-10 min or S4/ S5-1200 cycles per hour or S4/ S5-600 cycles per hour depending upon the rating and application of the actuator.
- 02 Each actuator will be provided with 'Open' and 'Close' torque and position limit switches. Once the torque switch has tripped in either direction, it can only be reset by operation of the actuator in the opposite direction. Each switch will have 2 NO + 2 NC potential free double break contacts. Switch contact ratings on inductive circuits will be 5A AC at 230 V AC. Actuator will be provided with motor over-riding feature like hand wheel for emergency manual operation and a limit switch will be provided which contacts will be used in the motor control circuit to forbid the motorised operation during manual operation by hand wheel. Also when the motor is switched 'ON' the hand wheel connection will be disengaged automatically. Motor operation will always have priority over manual operation.

Internal wiring will be tropical grade PVC insulated, stranded copper conductor cable of 10A rating for control circuits and required ratings for motor. All wires will be clearly numbered at both the terminal block and component ends. Cable ferrules will be robust and numbers will be indelible in nature.

The voltage grade of cables/ wires will be 1100V. Power terminals will be separated from the control terminals by means of an insulating cover. Separate terminal block fitted to switching unit will be provided. The terminal box will be designed for the protection class or IP-65. A durable terminal identification card showing plan or terminals will be provided attached to the inside of the terminal box cover indicating serial number, external voltage values, wiring diagram number and terminal layout.

The actuator will be suitable for operation at specified ambient temperature. All actuators will be neoprene O-ring sealed water tight and dust proof to IP-67 protection and will at the same time have an inner watertight neoprene O-ring seal between the terminal box and the internal electrical elements of the actuator, fully protecting the switch mechanism, motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal box cover is removed on site for cabling/ maintenance.

The actuators will be operated from the Remote Control Station and Local control station (LCS) will be provided separately for local operation of the

actuator for testing and maintenance purpose. Isolator along with starter for the actuator motor will be located in the Contractor's MCC. Separate power cable will be used for motor wiring.

04.10.13.04. Belt Weigh Feeders

General Technical Specification (GTS) will be referred for detailed specification of Belt Weigh Feeders.

04.10.13.05. Belt Weigh Scales

General Technical Specification (GTS) will be referred for detailed specification of Belt Weigh Scale.

04.10.13.06. Suspended Electromagnet/ ILMS

The magnet will be of high permeability cast steel as per IS : 4491 with an integral terminal box of adequate size. Leads will be brought to the terminal box through a water tight sealed gland. An earthing terminal will be provided inside the terminal box. The coil of the magnet will be designed for continuous duty for full supply voltage. The magnet will be fed from 220V DC obtained through rectifier panels.

The magnet coil will be Fiber glass wound copper wire and class H insulation will be used.

Control panel will be free standing, floor mounted, front attended, made of CRCA sheet steel of thickness not less than 2mm with IP54 enclosure class. In-comer feeder will have load break switch interlocked with the door.

Panel will have air cooled control transformer, full wave, silicon diode rectifier bridge having 220V DC output and complete with RC circuit across each diode, PIV of diode will not be less than 1560V.

Complete safety and protection equipment against surge voltages, discharge resistance in DC load side will be provided. Electronic temperature sensing circuits for protection against excessive temperature in the magnet coil will also be provided.

For In Line Magnetic Separator necessary electrics will be included.

04.10.13.07. Dust Suppression System

Control Panel for DS system will have necessary starter for Pump motors and 24V DC power supply arrangement for Solenoid valves. Valves will be energised either by Local Push button station or by under

belt switch depend upon selection of control mode. Necessary electrics will be provided for desired operation of pumps, compressors, valves etc. for DS system. DS system will be interlocked with corresponding conveyors / technological equipment. DS system will have local manual and remote auto mode control. Compressor may be connected to nearest MCC considering location of Compressor house.

Control panel for outdoor application will have weatherproof enclosure.

04.10.13.08. DUST EXTRACTION SYSTEM

The Dust Extraction System will be started first and will be suitably interlocked with corresponding conveyors / technological equipment. The equipment of D.E. system will be operated in sequence as per requirement in the REMOTE mode from the HMI. Power supply to bag filter panel will be interlocked with the DE fan. Bypass arrangement will be provided such that technological equipment may be operated without operation of DE system in case need arises.

Electrics for Bag Filter System of DE System.

The bag filters of D.E. system will consist of pressure switches cum indicator in the compressed air line, differential pressure switches, solenoid valves, control panel and all other associated equipment. The brief specification of the major components will be as given below:

01 Control panel for Bag filter

The control panel will be free standing floor mounting fabricated from 2.5 mm thick CRCA sheet steel on a base channel or 250 mm height provided with cable gland plates, having synthetic rubber gasketing provided with double door & canopy and enclosure conforming to IP-55. The control panel will be factory assembled, wired with 1.1 kV grade PVC flexible wire of copper conductor (minimum size 2.5 sq.mm), factory painted. The control panel will be provided with following major equipment :

- a) Incoming switch (minimum 30A, AC23 duty) with operating handle inter-locked with the door, HRC fuses, contactors, MPCBs in the various circuits.
- b) Control transformer or required VA rating having +/-5 percent and +/- 2.5 percent tapings in the primary side of the control transformer with Isolating switches/ MCBs in the primary & secondary sides.
- c) 24V DC power pack complete with fitter and protective elements and also isolation cum short circuit protection both at AC and DC

sides for power supply to solenoid valves.

- d) Auxiliary contactor for control power supply monitoring interlocking, and controls etc.
- e) Auto-manual selector switches, push button switches, indication lamps, various monitoring devices, terminals (with 20 percent spare terminals) and other circuit elements required for control and monitoring
- f) Solid State Bag filter timers.

02 The bag filter timer will be solid state device suitable for dusty, tropical and specified aggressive environment. The bag filter- timer will be provided with internal semi-conductor fuse protection and will have provision for pulse frequency setting and pulse duration setting through independent operating knobs. The number of contacts in the timer will be equal to number of solenoid operated valves so that the timer will energise only one solenoid valve at a time.

03 The Bag Filter Timer will provide timed sequential energisation of 24V DC operated solenoid valves of bag filters LEDs for each solenoid energisation. Power ON in PCB feed back relay will be provided with potential free contacts which will close under following conditions:

- i) Fault in the PCB.
- ii) Open contact in the output side connected to individual solenoid valves. The contact will not close in the event of power failure to the controller.
- iii) The sequential control (i.e. process) will start when the Differential Pressure (DP) switch is actuated at the first set point for normal operation. The process will continue till the pressure differential drops below the set value. When again the DP switch is actuated the process will continue from the previous position (i.e. next solenoid valve). However, when the power supply to sequential controller trips, the process will stop and sequential controller is reset to first load position enabling the process to start from the beginning.
- iv) Sufficient space will be provided for installation of bag filter panel with required front clearances for operation and maintenance including side and back clearances as required.

04 Differential Pressure Switch

- i) The differential pressure switch will have two sets of independent micro switches. The first set will be used for normal sequential

cleaning operation of the bag filters as per lower set value of differential pressure. This set point will be independently adjustable.

- ii) The second set of N.O. contact will close at upper set value of differential pressure representing clogging condition of bag filter and will be used for signaling and monitoring. This set point will also be independently adjustable. The contacts will be rated for 5 Amp, 240V AC.
- iii) The DP switch will be suitable for outdoor installation. The DP switch casing will be made of pressure die cast Aluminium with enclosure conforming to IP-65.
- iv) One number differential pressure switch with two set points will be provided for each module of the Bag filter. Alternatively, two numbers of DP switches may be provided for each module one for initiation of bag cleaning operation and other for signaling and monitoring of clogging condition.

05 Solenoids

The solenoid coil will have encapsulated coil (class 'F' insulated with a water proof (IP-65) plug-on connector. The coil will be suitable for 24V DC. The coil will be made of copper conductor.

06 Air Pressure Switch cum indicator

One number compressed air pressure switch cum indicator will be provided for each DE system in the incoming compressed air pipe line of the bag filter. The pressure range will match with the operating pressure. The switches will be snap action type with 1 NO + 1 NC contacts of SA, 230 V AC. These contacts will be wired up to terminals in the bag filter control panel. The enclosure of the air pressure switch will be pressure die cast aluminium conforming to IP-55.

04.10.13.09. Type of Light Fittings and Illumination Levels

Illumination level and light fittings will be provided for different units as indicated below :

SL. NO.	UNITS	ILLUMINATION LEVEL (LUX)	TYPE OF LIGHT FITTINGS
1.	Electrical rooms, substations, MCC Rooms etc.	200	Trough type, 2x40W, fluorescent tube light fittings with reflectors.
2	Junction Houses and Conveyor Galleries /	100	70W/150W, HPSV, well glass fittings and 250W

SL. NO.	UNITS	ILLUMINATION LEVEL (LUX)	TYPE OF LIGHT FITTINGS
	tunnels		High bay as required.
3	Crusher house, other process and Technological Building	150	70W/150W, HPSV, well glass fittings and 250W High bay fitting as required
4.	Office rooms	300	Trough type/Decorative recessed type, 2x40W, fluorescent tube light fittings.
5.	Corridors, walkways, staircase	100	Trough type, 2x40W fluorescent tube light fittings with reflectors.
6.	Control room, laboratories, instrumentation rooms.	300	Decorative type, 2x40W fluorescent tube light fittings with mirror optics.
7.	Battery room	100	Corrosion/Vapour proof, 2x40W fluorescent tube light fittings.
8.	Battery Charger/ UPS room	200	Decorative type, 2x40W fluorescent tube light fittings with mirror optics.
9.	Periphery of buildings and cooling towers	50	70W, well glass fittings with HPSV lamps.
10.	Pump Houses	200	70W/150W, well glass fittings with HPSV lamps.
11.	Area lighting through flood light towers	20	400W, flood light fittings with HPSV lamps.
12.	Area and road lighting	20	250/400W, flood light fittings with HPSV lamps and 250W, street light fittings with HPSV lamps.

Number of light fittings will be decided on the basis of specified lux level, maintenance factor 0.6 and appropriate co-efficient of utilization as per manufacturer's recommendation.

04.10.14. DRAWINGS AND DOCUMENTS

Contractor's scope of work for all design drawings and documents will be as given below.

The Contractor will submit a list of all drawings and documents he

proposes to submit within 2 weeks of LOI. The list will be approved by Client / MECON and may be modified if necessary. Each drawing/documents in the list will be identified with a serial number, description and scheduled date of submission. All the drawings will have complete forward & backward reference.

Contractor will also furnish soft copies of all the drawings indicated below and drawings of technological layout/units.

All design, engineering and manufacturing drawings will be required to be approved by EMPLOYER/Consultant.

Work will be carried out exactly as indicated on the approved drawings and specification. No alterations will be made without prior written approval by EMPLOYER / his consultant.

The Contractor will check all the drawings prepared by them and/or received from their vendors/supplier/sub-supplier and satisfy themselves about the correctness of drawings before issuing to EMPLOYER/Consultant. After checking, properly stamped drawings will be sent to EMPLOYER/Consultant for approval / clearance.

Comments on all drawings will be forwarded to the Contractor for incorporation and resubmission.

The approval of drawings by EMPLOYER or their authorised representative does not absolve or relieve the supplier from any of his obligations under this contract and he will be wholly and solely responsible for the satisfactory operation and guaranteed performance of equipment / system / plant.

A. Basic Engineering drawings (To be Submitted For Approval)

1. List of drawings (Basic Engg /Detailed Engg/ Reference) and drawing numbering system along with schedule of submission.
2. Single line diagrams of HT/LT switchgear equipment, PCCs, MCCs /Control Panels, PDBs, MLDBs, LDBs, SLDBs, Main fire detection and alarm panel etc. with rating of components, cable sizes and details of protection and metering etc.
3. HT & LT Motor and component list including field mounted electrics
4. HT and LT Motor data sheets as per enclosed format.
5. Type-II Co-ordination chart as per IS: 13947-1993 for MPCB/ MCCB, Contactor and Overload relay.
6. Schematic drawing of different feeders, control, alarm, indications,

interlocking and other schematics.

7. Shop/Unit wise Maximum Demand calculations
8. Relay settings with calculations for total network to ensure proper co-ordination.
9. Busbars sizing calculation with respect to temperature rise & short circuit withstand capacity.
10. Design Calculations for selection of main equipment such as transformers drive motors, AC drives, bus bars, cables, batteries etc.
11. Typical schemes of DOL, RDOL feeders indicating inputs & outputs applicable to the various feeders indicated in SLDs.
12. Power and regulation schemes of AC drives.
13. Calculation for temperature rise of busbars.
14. Layout of substations, electrical rooms and control rooms including ventilation and air-conditioning rooms, handling facilities. The layout drawings indicating cable trench, wall openings, conduit inserts, plate inserts, Minimum clearances from electrical panels for installation of panels, cable trays, conduits for concealed wiring etc.
15. Electrical Equipment Layout of all electrical rooms, control rooms indicating panel dimensions, space available for future expansion with building dimensions.
16. General arrangement of equipment with plan, front view and sectional views, comprehensive bill of materials with description, quantity, make and type.
17. Cable layout drawings in cable tunnel, cable channels, overhead cable structures/bridge and incoming cable route etc.
18. Interplant cable route drawings.
19. Type tests certificates of all major equipment like transformers, switchgear etc.
20. Level-1 automation system configuration & I/O lists, Belt Scale, Belt Weigh feeder, UPS & VVVF single line diagrams.
21. Functional description, control philosophy for the plant indicating start up, shut down, control locations, interlocking and annunciation system, mimic pages, report/data formats (for reference).

22. Scheme for Illumination system & emergency lighting system indicating sizes, ratings & locations of various LDBs & SLDBs.
23. Tentative Dimensions of panels.
24. Earthing and lightning protection scheme and layout of earthing and lightning protection network with calculations.
25. Basic interconnection scheme for FDA, Telecommunication & PA system.
26. Quality assurance plan for various electrical equipment.

B. Detailed engineering drawings. (To be Submitted For Approval)

1. Civil/Structural engineering design drawings of Electrical buildings, Electrical rooms, Control rooms, Motor foundations, Cable tunnels, Overhead cable structures/Bridge etc.
2. General arrangement of all electrical equipment/electronic panels/controllers with plan, front view and sectional views, comprehensive bill of material with description, quantity, make and type.
3. Equipment and cable layout drawings in LT Substation, Electrical premises, Control rooms etc.
4. Schematic drawing of different feeders, control, alarm, indications, interlocking, inputs/outputs to PLC and other schematics.
5. Single line diagrams of all ACDBs, PCCs, MCCs/ Control Panels, PDBs, MLDBs, LDBs, SLDBs, UPS, other equipment Control panel for sump pump, magnet and other auxiliary system etc. Module wiring diagrams indicating all interlocks, terminal numbers. Wiring terminal plan drawings with cable connections.
6. Single line diagram of VVVF Drives, Soft Starter etc.
7. GA, BOQ, Layout drawings, dimensional details for LT switchgear equipment, MCCs/Control Panel, PDBs, MLDB, LDBs, SLDBs, Main fire detection and alarm panel etc. with rating of components, cable sizes and details of protection and metering etc.
8. Level-1 automation system software and graphic displays.
9. I/O listing in specified format to be finalised during engineering.
10. Sizing calculation of the UPS and the backup battery. UPS panel

wiring diagram and circuit diagrams.

11. Wiring terminal plan drawings with cable connections.
12. Technical data sheets for Motor, Brake, Proximity switches & all field mounted electrics, GA drawings.
13. Interplant cable route drawings.
14. Layout of cable trays in cable cellars inside the substation & other electrical premises, cable channels, cable tunnel, overhead cable structures, cable shafts etc.
15. Cable layout drawings in cable tunnel, cable channels, overhead cable structure (as applicable), and incoming cable route etc.
16. Power & control cable schedules
17. GA drawing for erection accessories like cable trays, supporting structures etc.
18. Installation drawings of all equipment with layout of equipment, cables.
19. Illumination layout of all the indoor & outdoor premises. Layouts at each floor of Electrical/Technological building with details and numbers & locations of light fittings, Lighting distribution boards etc. SLDs of Lighting distribution board.
20. Detail scheme of FDA system, List of annunciation/alarm points (location wise) & wiring scheme
21. Earthing and lightning protection scheme and layout of earthing and lightning protection network with calculations including special electronics earthing.
22. Relay settings with calculations for total network to ensure proper co-ordination.
23. Communication cable (Field bus) routing and procedure for laying of communication cable.
24. QAP for all items covered in this specification

C. For Reference/Erection purposes

1. Schedule of electrics, and their location.

2. HT/LT feeder requirement with individual maximum demand.
3. Control circuit diagrams. The control circuit diagram should be available on / inside of respective panel / LCS.
4. Static and dynamic loading of all major equipment
5. External connection diagram (panel wise and scheme wise).
6. Composite drawings showing circuitry of switch-gear remote panels, and other items pertaining to complete circuit for its proper functioning.
7. Power & regulation schemes for AC drive, UPS, soft starter including FCMA type.
8. Motors & field devices.
9. Speed-torque, current vs. time, thermal withstands characteristics for motors.
10. List of interfaces between Contractor's equipment and EMPLOYER's equipment.
11. Cable termination plans with terminal block arrangement and markings.
12. Interconnection diagrams.
13. Internal wiring diagrams of equipment.
14. Fire detection systems: layout & cable list.
15. Motor and electric consumer list.
16. Consolidated Bill of materials and volume of work for erection.
17. Procedure for testing and commissioning of the entire plant, electrical & automation equipment. This will also be furnished in soft copy.
18. Erection specification with bill of materials of erection materials, earthing materials, junction box, GI conduits etc. This will also be furnished in soft copy.
19. Spare part list and drawings.
20. Instruction for storage /erection, testing & commissioning.
21. Operation and maintenance manual.

22. Detailed technical literature / catalogue of manufacturers.
23. Graphic display sheets, report/data generation, fault listing etc.
24. Terminal plan drawings
25. System grounding/ earthing scheme
26. Application software program listings with detailed documentation.
27. Ladder Logic diagram /Statement Lists and software details.
28. Formats and work sheets for generation and display of overview, groups, loops, graphics, alarms, operator's guide messages, real time and historical trends Log and shift formats.
29. List of drawings & spare parts.
30. Final test & calibration certificates and guarantee certificate / warrantee certificate.
31. As built Control description with Operational instruction use of various commands, instruction for control of plant and equipment from Operator workstation.
32. Drawings/documents for inspection of equipment:
 - a) Type test certificate for identical equipment.
 - b) Sub-supplier's/vendor's catalogue/technical literature.
 - c) Test reports for internal inspection.
 - d) Test certificate of components.
 - e) Technical specification & data sheets of equipment.
 - f) All "Approved" drgs./ "Commented" drgs as applicable.
33. Automation systems.
 - a) Software including media and documentation.
 - b) Description of all components of the user system with functional description, overview flow diagram, interface listing, mathematical models, and fault message lists, operator commands, simulation facilities, etc.
 - c) Source code of the user system.
 - d) Object code of the user system.
 - e) I/O listing
 - f) Ladder/block diagrams, etc.
 - g) Factory Acceptance Tests & procedures for PLC/DCS

34. Other Drawings/documents :

- a) Operation & maintenance manual.
- b) Catalogues and manuals.
- c) All "As-built" drawings.
- d) Soft copies of all drawings.
- e) Technical specification/data sheet of equipment.
- f) Instructions for storage/erection/testing/commissioning
- g) Commissioning report.

The Contractor will submit all the drawings in Si-graph or equivalent format along with the multi user system software.

D. As built drawings

Upon installation and commissioning supplier will incorporate revisions/modifications if any in the reproducible and submit 'as built' drawings for EMPLOYER's record as per general condition of contract.

Complete and comprehensive instruction manuals for operation and maintenance of the equipment with drawings. This will include the following:

1. Log sheets indicating daily/hourly recordings of power system parameters to be noted down by customers operating personnel. The parameters will indicate loading of various electrical equipment quality of power supply, energy consumption of various units, energy consumption and maximum demand of the plant.
2. Preventive maintenance schedule for equipment.
3. Procedure for shut down and energisation.
4. Safety procedures for safe operation of equipment and complete system.
5. Specification of equipment installed.
6. Test procedure for site tests.
7. All as built drawings.
8. Spares list for each equipment for 2 year operation and maintenance.
9. At least two sets of clearly legible site corrected drawings will be submitted after commissioning

10. As built drawings will be first Copy / Clear photo copy and will be properly arranged in suitable folders. The folders will have a list of all the drawings it contains on the front inside cover. Different folders will be used for different major categories like 11 kV switchgears, MCC / PDB, Drives etc.

04.10.15. FORMAT FOR MOTOR DATA SHEET

1. PROJECT :
2. MAKE :
3. DRIVEN EQUIPMENT :
4. MOTOR TAG NO. :
5. QUANTITY :
6. VOLTAGE WITH VARIATION :
7. NO. OF PHASES/CONNECTION/ NO OF TERMINALS :
8. FREQUENCY WITH VARIATION :
9. FAULT LEVEL (MVA) & DURATION :
10. MOTOR TYPE AND DUTY :
11. kW RATING/POLE :
 - AT 40 DEG. C. :
 - AT SPECIFIED AMBIENT TEMP.: :
 - WITH DERATING. :
 - BHP/BKW OF DRIVEN EQPT. : :
 AT RATED LOAD
12. FRAME SIZE/MOUNTING :
13. INSULATION CLASS WITH TEMP RISE:
14. ENCLOSURE TYPE :
15. FULL LOAD SPEED :
16. FULL LOAD TORQUE (FLT) :
17. STARTING TORQUE AS % OF FLT :
18. PULLOUT TORQUE AS % OF FLT :
19. FULL LOAD CURRENT (FLC) :
20. STARTING CURRENT AS % OF FLC :
21. STARTING TIME ON RATED LOAD AT :

- RATED VOLTAGE :
- 85 % OF RATED VOLTAGE :
- 22. LOCKED ROTOR WITHSTAND TIME
 - COLD :
 - HOT :
- 23. ROTATION VIEWED FROM DRIVING END
- 24. GD SQUARE OF MOTOR :
- 25. GD SQUARE OF DRIVEN EQUIPMENT:
- 26. WEIGHT OF MOTOR :
- 27. POWER FACTOR AT
 - 50 % LOAD :
 - 75 % LOAD :
 - 100 % LOAD :
- 28. EFFICIENCY AT
 - 50 % LOAD :
 - 75 % LOAD :
 - 100 % LOAD :
- 29. SPACE HEATER WATTS/VOLTS :
- 30. TERMINAL BOX TYPE & :
NO. OF TERMINALS
- 31. NO. OF STARTS PER HOUR :
- 32. NOISE LEVEL AT A DISTANCE OF 1M :
FROM THE MOTOR
- 33. THERMAL WITHSTAND TIME :
- 34. COOLING :
- 35. APPLICABLE STANDARD :
- 36. LOCATION :
- 37. HAZARDOUS AREA CLASSIFICATION :
- 38. BEARING DETAILS
 - TYPE OF DE/NDE :
 - SIZE OF DE/NDE :
 - MAKE :

39. LOCATION OF TERMINAL BOX :
POSITION FROM DE SIDE
40. LUBRICATION TYPE :
41. CABLE SIZE :
42. PAINT SHADE :
43. G.A., DIMENSIONS & MOUNTING : YES/NO
DETAIL DRAWINGS ENCLOSED
44. DETAILS DRAWINGS FOR T.B. : YES/NO
45. PERFORMANCE CHARACTERISTICS : YES/NO
CURVES VIZ. SPEED V/S CURRENT &
SPEED V/S TORQUE ENCLOSED

TOOLS & TACKLES (ANNEXURE-E01)

Sl, No.	Item	Quantity (Nos.)
1.	True RMS Digital Multimeter (hand held)	8
2.	Digital tong tester (hand held)	8

3.	Testing Jig for PLC (OEM supplied)	3
4.	Low range ohm meter	4
5.	Megger (0– 500V)	8
6.	Megger (0-1000V)	5
7.	Megger (0-2500V)	6
8.	Earth Meggar	4
9.	Milli ohm meter	2
10.	Combination pliers	4
11.	Nose pliers	6
12.	Hand drills (pistol)	8
13.	Allen key	6 Sets.
14.	Ratcher Spanner Set	6 Sets
15.	Ring Spanners of different sizes	7 Sets
16.	DE Spanners of different sizes	8 Sets
17.	Vibration monitor (hand held)	6
18.	Soldering / de-soldering station	3
19.	Testing table / bench for installation of testing / repair equipment complete with single phase / three phase power supply points and separate electronic earthing	1
20.	Blower cum vacuum cleaner (portable)	5
21.	Tool kit (screw driver set, spanner set etc.)	8 sets
22.	Component storage steel rack (pigeon hole)	3
23.	Steel Almirah for storage of test equipment	10
24.	Bench vice	6
25.	Power saw suitable for bakelite / hilem board cutting	1
26.	Cable Preparation & Termination Toolkit (for special cables), including Crimping Tool	1 set
27.	HT Line Tester	5 Nos.
28.	Steel chairs	12
29.	Steel tables	4
30.	Radio communication Equipment testing Jig	1 Set
31.	F.O Cable Testing Kit including OTDR	1 Set
32.	Field bus Analyzer	1 Set
33.	Radio communication Analyzer	1 Set
34.	Tools for backup & storage <ul style="list-style-type: none"> DVD-RW 	50 Nos

	<ul style="list-style-type: none"> • Thumb drives • Backup Tape for Servers • Cleaning Tape • Disk Imaging S/W for Server & clients 	10 Nos 20 Nos 2 Nos 1 Set
35.	Ethernet Analyzer	1 Set
36.	Portable Oscilloscope	1 Set
37.	Hydraulic fan puller	1 Set
38.	Box Spanner Set	1 Set
39.	Hydraulic Coupling Puller	1 Set
40.	Hydraulic Bearing Puller	1 Set
41.	Cable Fault Locator Machine	1 Set
42.	Motorized torque range	1 Set
43.	PCB Cutter	1 Set
44.	Motor Checker	1 Set
45.	Current Recording meter	1 Set
46.	1.5 mm/ 2.5 sq.mm Crimping Tool	1 Set
47.	AC/DC Digital tongue testor	1 Set
48.	Welding Transformer	1
49.	Power Hack Saw	2
50.	Grinding machines	2

ANNEXURE – E-02

SCHEDULE OF MINIMUM COMMISSIONING SPARES FOR ELECTRICAL EQUIPMENT FOR PKG.-064

The Contractor will supply following minimum commissioning spares along with the main equipment. However, during testing and commissioning of the plant, in case of requirement of any additional commissioning spares, same will be supplied by Contractor without any extra cost to the Employer. The Contractor will hand-over / deliver these spares directly at the Employer's stores. During testing and commissioning in case of requirement of any commissioning spares, same will be brought by the Contractor from Employer's stores. All unused commissioning spares will remain with the Employer.

SL. NO.	DESCRIPTION	QUANTITY
I.	<i>Transformer</i>	

1	HT Bushing	1 No.
2	Winding temperature indicator with alarm & trip contacts	1 No.
3	Gasket	1 No.
II.	LT Switch Gear	
1	Auxiliary Contact Set	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2	Closing Coils	
3	Tripping Coils	- DO -
4	Ammeters	- DO -
5.	Voltmeters	- DO -
6.	Coils for the Contactors & Aux. Contactors	- DO -
7.	Control Isolating & Selector Switch	- DO -
8.	Push Button of Various Colours	- DO -
III.	MCCs, PDBs, MLDB/LDBs	
1.	Air Circuit Breakers	
a)	Fixed arcing contact	- DO -
b)	Moving arcing contacts	- DO -
c)	Arc chute	-DO-
d)	Cluster contacts	-DO-
e)	Arc barriers	- DO -
f)	Trip coil assembly	- DO -
g)	MWS complete kit	-DO-
h)	Closing coil assembly	-DO-
2.	MPCB of different ratings	- DO -
3.	MCCB of different ratings	- DO -
4.	Handles of MCCB of different ratings	-DO-
5.	Power contactors of different ratings	-DO-
6.	Moving contacts of Power contactors of different ratings	- DO -
7.	Fixed contacts of Power contactors of different ratings	- DO -
8.	Coil for Power contactors of different ratings	-DO-
9.	Auxiliary contacts for Power contactors	-DO-
10.	MPR Overload relays of different ranges	-DO-
11.	Microprocessor based Over load relay for Conventional type MCC	- DO -
12.	Intelligent module/cards for intelligent MCC / MCP	- DO -
13.	Auxiliary contactor (2NO+2NC)	- DO -
14.	Coils for auxiliary contactors	-DO-
15.	Add on block for auxiliary contactors	-DO-
16.	CTs	- DO -
17.	PTs	- DO -
18.	Voltmeters	-DO-

19.	Ammeters	-DO-
20.	Ammeter selector switch	- DO -
21.	Voltmeter selector switch	- DO -
22.	Control switches	-DO-
23.	Control MCBs	-DO-
24.	Indicating lamps (LED) with holder	- DO -
25.	Busbar support insulators	- DO -
26.	Push buttons switches (start & stop)	-DO-
27.	Contact block (2NO+2NC) for start & stop PB	- DO -
28.	Actuator head for start & stop PB	-DO-
29.	Local-off-Remote selector switch	- DO -
30.	Control switch spring return type	- DO -
IV.	LOCAL CONTROL STATIONS	
1.	Push buttons (start)	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Push buttons (stop)	- DO -
3.	Contact block (2NO+2NC) for start & stop PB	- DO -
4.	Actuator head for start & stop PB	-DO-
5.	Ammeters	-DO-
V.	MOTORS (OF EACH TYPE & RATING)	
1.	Bearing (DE)	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Bearing (NDE)	-DO-
3.	Cooling Fan	-DO-
4.	Terminal Block	-DO-
5.	Grease Nipple & Plug, Grease pump with motorised.	-DO-
VI.	PLC/automation	
1.	Digital input module with connection unit if applicable.	10% of each type & rating. (minimum 1 set/ No. of each type & rating)
2.	Digital output module with connection unit if applicable.	- DO -
3.	Analog input module with connection if applicable.	- DO -
4.	Analog output module with connection if applicable.	-DO-
5.	Processor card	-DO-
6.	Power supply unit for PLC	- DO -
7.	Memory board (Part of CPU Board)	- DO -
8.	Communication modules	- DO -
9.	Control modules of any other type	-DO-
10.	Control fuse set consisting of 3 nos.	- DO -
11.	Fan unit	-DO-

12.	Fused terminals with LED	-DO-
13.	Special connectors/cables/ TERMINATORS	-DO-
14.	Racks / Chassis	-DO-
15.	Interposing relays / Relay Boards	-DO-
16.	Ethernet switches	-DO-
17.	Media converter	-DO-
18.	Radio comm. Equipment including antenna	-DO-
19.	Load power supply	-DO-
20.	Special cards in PC / servers/ clients / PG	-DO-
VII.	UPS	
1.	Thyristors cell (Complete assembly)	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Semiconductor fuses set consisting of 3 Nos.	- DO -
3.	Diodes	- DO -
4.	Regulation & pulse generation modules	-DO-
5.	Static bypass control module	-DO-
6.	Capacitors	- DO -
7.	Resistors, varistors	- DO -
8.	CTs	- DO -
9.	Surge suppression unit	5% of each type & rating. (minimum 1 set/No. of each type & rating)
10.	Power transistors/IGBT	-DO-
11.	DC MCCB	-DO-
12.	Indication LED	- DO -
13.	Pulse transformer unit	- DO -
14.	Trigger pulse generator	- DO -
VIII.	VVVF DRIVES / SOFT STARTER	
1.	IGBT of each type	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Diode of each type	-DO-
3.	Fuses of each type	- DO -
4.	Regulation Cards of VVVF, each type	- DO -
5.	Pulse transformer unit	-DO-
6.	Trigger Pulse Generator	-DO-
7.	RC Snubber Unit	-DO-
8.	HRC Fuse Link	-DO -
9.	Push Button actuator with contact element (Red & Green)	-DO-
10.	Mushroom head push button actuator	-DO-
11.	LED indication lamp (Red, Green, Yellow)	-DO-
IX.	BELT SCALES	
1.	Load Cell	5% of each type & rating. (minimum 1 set/No. of each

		type & rating)
2.	Electronic cards	-DO-
3.	Display Units	-DO -
X.	SAFETY AND LIMIT SWITCHES	
1.	All Types of Limit Switches	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Level Sensor / Switches	-DO-
3.	Photo Electric Sensor	-DO-
4.	Transducers	-DO-
5.	Flow Switches	-DO -
6.	Temperature Switches	-DO-
7.	Proximity Switches	-DO-
8.	Encoders	-DO-
9.	Magnetic Switches	-DO-
10.	Code Reader for Oven identification	-DO-
XI.	HYDRAULIC UNIT	
1.	Solenoid Valves	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Oil Seals	-DO-
3.	O-rings	-DO -
XII.	ILLUMINATION	
1.	MCBs	5% of each type & rating. (minimum 1 set/No. of each type & rating)
2.	Ballast for High bay, well glass, street light fittings etc.	- DO -
3.	Chokes, starter, holder for fluorescent tubular fittings	- DO -
4.	Igniter for Flood light, High bay, well glass, street light fittings etc.	-DO-
5.	Capacitor, holder, control gear for Flood light, High bay, well glass, street light fittings etc.	-DO-
6.	Fluorescent fixture	- DO -
7.	Well glass HPSV lamp fittings	- DO -
8.	Flood light, High bay, Street light fittings etc.	- DO -
9.	40W fluorescent lamps	- DO -
10.	70W, 150W, 250W, 400W HPSV lamps	-DO-
11.	Terminal blocks	- DO -

ANNEXURE – E-03

ADDITIONAL POINTS FOR AUTOMATION WITH RESPECT TO GTS

Sl. No.	GS Clause	Additional Points for Automation
1.	Ch-1, 06.03.01	Drawings of all listed categories (except fabrication drawings) will be submitted to EMPLOYER in minimum 6 sets.
2.	Ch-1, 06.03.03	Original hardcopy documentation and manuals are to be supplied, for all relevant hardware, software, network, technology, etc.
3.	Ch-3(Elect), 1.02.15.01.A.2.0	For all equipment with redundant power supply, supply from two separate sources will be drawn.
4.	Ch-3 (Elect), 1.01.15.02.A	No mode selection at LCS.
5.	Ch-3 (Elect), 1.02.21.02 (10)	Conduits carrying special cables will be painted, coded, marked as per plant norms.
6.	Ch-3(Elect), 1.02.15.01.B.16.0	Provisions to be made for off-line testing of Level-I systems prior to actual deployment.
7.		Max CAT-6 length of 30m for shop floor installations.
8.		Necessary facility/software will be supplied for remote management and monitoring of the entire network.
9.		Network teams from multiple switches to be employed for all the important machines (computers).

ANNEXURE-E04

SL. NO.	DESCRIPTION
1.	The HT and control cable from HTSS to the respective technological package will be routed through covered structural overhead cable gallery only.
2.	All circuit breakers used for 6.6 KV and 11 KV unearthed system should be <ol style="list-style-type: none">1. VCB's2. They will be horizontal isolation type, trolley mounted and ground operated (non cassette type)3. The jaw contacts (female) will be mounted on the breaker and will be drawout along with the breaker.4. The male contact will be of flat type with mounting on bus side5. Type tests pertaining to BIL requirements (7.2/28/60KV for 6.6 KV and 12/35/75 KV for 11 KV) will be witnessed by EMPLOYER.6. Minimum panel width will be 800 mm.
3.	Continuous current of Variable speed AC drives will be 150% of motor full load rated current at continuous duty operation.
4.	Insulation level for MCC & MCP: One minute power frequencies withstand voltage will be 1500V for control circuit.
5.	Contact rating for Push Button will be AC15, 6A at 230V DC13 ,4A at 230 V
6.	MCB short circuit rating capacity will not be less than 10 KA at 0.8 power factor
7.	LT Switchboard Incomer & Bus-coupler Circuit Breaker ratings will be 2000A for 1000KVA transformer
8.	Control terminal block will be ELMEX type suitable for terminating 2 cores of 2.5 sq mm wire.
9.	Terminal type Power terminal: Stud type- with maximum 2 connections on one terminal. Control terminal for CT: Disconnecting type

ANNEXURE-E05

SL.	DESCRIPTION
-----	-------------

NO.	
1.	All HT motor will have FCMA based soft starter.
2.	For HT motor surge suppressors to be installed near the motor.
3.	All HT motors will have fluid coupling.
4.	HT motors less than 2.0 MW, condition monitoring equipment (temperature monitoring, vibration monitoring etc.) to be envisaged. For more than 2.0 MW, condition monitoring equipment (temperature monitoring, vibration monitoring and partial discharge monitoring etc.) to be envisaged.
5.	Isolated transformer will be provided for VVVF drive of more than 90 KW, and series reactor will be provided for VVVF drive less than 90 KW.
6.	Copper cable will be used for imported motors, crane and moving equipment.
7.	For all LT motors for more than 75KW soft starter will be provided.
8.	All HT cable will be of FRLS type.

04.11 AUTOMATION SYSTEM (LEVEL-1)

04.11.01 GENERAL

- 01.** This specification is intended to define the basic requirements for Automation (Level-1) system of the Coal Handling Plant (CHP) and Coke Sorting Plant (CSP) and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (FFP) coming under the 7.0 MTPA Expansion of BHILAI Steel Plant (BSP) with a view to achieve smooth, efficient, safe, integrated and reliable operation of the process.
- 02.** Monitoring, Control, Interlocking and Sequential functions for the entire Coal Handling Plant and Coke Sorting Plant and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be achieved through PLC based Level-1 automation system.

03. Coal Handling Plant

- A common dispatcher cum control room (D-2) under package no. - 062, is being arranged by the employer for operating the entire coal blending, crushing and transportation from existing & new silos to existing batteries (10 nos.) and new battery (1 no.) with a provision to install the automation equipment of proposed CHP package-064 as shown in the attached Automation Configuration Drg. No. - **MEC/S/9101/11/E9/55/01/064.01/R1**). Contactor will provide PLC-4 with all hardware and software and integrate the offered system with that of Pkg 062(New Coal Handling Plant).
- To understand the interfacing points, enclosed Material flow diagram (Drg No-**MEC/S/9101/11/17/55/01/064.12, Sheet 1&2**) and a schematic drg (**Drg. No.-MEC/S/9101/11/E9/0/00/00/064.03**) may be referred.
- The Contactor will furnish assignment drawing and space requirement to the employer to keep the provision in the Despatcher-D2.

04. Coke Sorting Plant-

- Control, Monitoring, Interlocking and Sequential functions of new drives and equipment proposed for Coke sorting plant covered under this specification as per technological layout and material flow diagram with new automation. Proposed CSP will receive material from CDCP (for COB#11), Existing Coke Sorting Plants CSP-1 through Conveyor KA1 and KA2 which in turn after crushing & screening material will transport to Stock House of BF#8 and SP-III through C-line conveyor (Pkg064) in line with technological material flow diagram.
- For operation of Coke sorting plant, a separate new Dispatcher will be provided by the Contactor with dedicated PLC based automation

system as per Automation Configuration Diagram (MEC/S/9101/11/E9/55/01/064.02/R1).

- In the new Automation system, provision will be kept for interfacing employer's PLC and /or Remote I/O stations for all source and destination conveyors.

05. Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III- Control, Monitoring, Interlocking and Sequential functions of new drives and equipment proposed for Augmentation of Flux and Fuel crushing and screening circuit as described below in line with material flow diagram:

- i. Feeding of coke breeze from coke breeze bunker of coke sorting plant(CSP4) to existing conveyor C102
- ii. BF fines from existing BFs through conveyor C7, new conveyor C3A-C1 to existing Conveyor F101 in junction house JH 127.
- iii. Feeding of sinter /ore fines from BF8 fines storage bins to existing conveyor F101 in junction house JH 127
- iv. Feeding of coke fines from BF8 fines storage bins to existing conveyor C102.
- v. New Fuel & Flux Crushing and Screening system
- vi. New Conveyor route starting from C104 through Rod Mill feeding to existing Proportioning building.
- vii. New Conveyor route starting from L105 through Hammer Crusher feeding to existing Proportioning building.

The above will be achieved by providing new hot redundant PLC with suitable remote I/O station. New PLC will be integrated to the existing PLC based Automation system by providing suitable gateway as shown in the enclosed Automation Configuration Diagram. For interfacing with New Sinter machine suitable gateway also will be provided for establishing interlocking, signal, monitoring etc.

- The Automation system facilities will be generally offered inline with the basic 'Automation System Configuration' diagram (**Drg. No: MEC/S/9101/11/E9/55/01/064.04/R3**) enclosed with this specification for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III.
- Contractor will provide gateways, all hardware and software required for integrated operation of the new drives defined above along with the existing equipments for flux and fuel crushing & screening facility and the associated conveyors in existing Rockwell make 5-60/5-80 series PLC based Automation system.

- Conveyors feeding to Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III i.e. C7-3.5KW, C1-30KW & C2-45KW will be fed from new MCC under the scope of package. These Conveyors will be connected from new PLC of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III. Suitable control cable and other accessories will be considered.
 - Necessary modification, if required for laying of cables and mounting equipment in the existing control room CR1, the same will be provided by the Contractor.
- 06.** This specification should be read together with the General Technical Specification (No. GS-03) separately attached with this specification, General Conditions of Contract (GCC) and other commercial terms & conditions.
- 07.** Automation equipment considered for the process will be complete in all respect in line with this specification. Any equipment / accessories, not explicitly indicated in this specification, but considered essential for proper functioning of technological equipment and process (including utilities) will be included by Contractor in their scope of work and supply.
- 08.** All the automation equipment will be supplied brand new & from the latest product ranges of reputed manufacturers as per the List of Preferred Makes, furnished in this Contract document. Employer/ Consultant reserve the right of selecting particular make and model of Automation equipment with a view of integration with employer's Automation system and standardization of the whole plant. Contractor will comply with such requirements.
- 09.** Contractor will execute the entire automation work as part of turnkey package of the CHP and CSP, Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III to the satisfaction of Employer/ Consultant. Contractor will comply with all the requirements indicated under General; Salient Features of Automation system, Scope of Work and Supply; Submission of Drawings & Documents and other related clauses/ annexure stipulated in this specification. Design aspects and selection criteria of PLC systems and also other hardware/ peripheral units have been elaborated in GTS. The GTS (GS-03) is being issued as a separate document along with this Contract, which will also be complied with.
- 10. Interfacing:**
- **Coal Handling Plant:** -Automation systems of CHP (Pkg-062), new Coke Oven Battery-11, etc. will be separately arranged by Employer along with its technological package. The proposed PLC based automation system of Coal Handling Plant (Pkg-064) will be interfaced

with CHP (Pkg-062), new Coke Oven Battery-11 & existing plants / shops as per Technological Material Flow Diagram for information exchange, interlocking and monitoring of the plant. Contactor will provide required hardware & software for interfacing of the offered automation system with the automation system of the above plants. The required communication bus from the PLC of the above plants to respective Despatcher / Control Room of the Contactor's offered Coal Handling Plant will be included under this package. Details of interfacing requirement will be finalised during detailed engineering stage.

- **Coke Sorting Plant:** Automation systems of CDCP (for Coke Oven Battery-11), Stock House of Blast Furnace # 8, etc. will be separately arranged by Employer along with its technological package. The PLC based automation system of CSP (Pkg-064) will be interfaced with CDCP (for Coke Oven Battery-11), Stock House of Blast Furnace # 8, Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (Pkg-64) & existing CSP 1 plant as per Technological Material Flow Diagram for information exchange, interlocking and monitoring of the plant. Contactor will provide required hardware & software for interfacing of the offered automation system with the automation system of the above plants. The required communication bus from the PLC of the above plants to respective Despatcher / Control Room of the Contactor's offered Coke Sorting Plant will be included under this package. Details of interfacing requirement will be finalised during detailed engineering stage.
 - Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III: Automation systems of Blast Furnace #8, Sinter Plant#3 etc. will be separately arranged by Employer along with its technological package. The PLC based automation system of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III (Pkg-064) will be interfaced with stockhouse of Blast Furnace #8, Sinter Plant #3, CSP (Pkg-64) , Existing Coke handling, crushing and screening facility, Existing Flux crushing and screening facility, etc. as per Technological Material Flow Diagram for information exchange, interlocking and monitoring of the plant. Contactor will provide required hardware & software for interfacing of the offered automation system with the automation system of the above plants. The required communication bus from the PLC of the above plants to respective Despatcher / Control Room of the Contactor's offered Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be included under this package. Details of interfacing requirement will be finalised during detailed engineering stage.
- 11. The Automation system facilities for CHP, CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III of this package (064) will be generally offered inline with the basic 'Automation System Configuration' diagram (Drg. No: MEC/S/9101/11/E9/55/01/064.01/R1) for CHP & Drg. No:**

(MEC/S/9101/11/E9/55/01/064.02/R1)for CSP and (Drg. No: MEC/S/9101/11/E9/55/01/064.04/R3)MEC/S/9101/ 11/E9/0/00/00/064.04/R3 for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III) enclosed with this specification. Client-server based architecture will be considered for automation. Contactor will submit configuration diagram of the automation system provided by them accordingly. Requirements of Controllers & their division, Work-stations/Servers, Engineering stations, Printers etc. will be indicated in the configuration drawing.

12. Automation system of proposed plants will have three level Ring Architecture type communication buses as follows :
 - a) HMI-level Ethernet for HMI Stations, MIS Servers, MIS Clients, Higher-level systems etc. Contactor to provide for CSP in line with Automation Configuration drawing.
 - b) Control-level Ethernet for connecting PLCs, Servers, Emergency Work Stations, Engineering Stations etc. Contactor to provide for CSP in line with Automation Configuration drawing.
 - c) I/O level communication bus. Contactor to provide for CHP & CSP in line with Automation Configuration drawing.
13. 1 No. field programming unit for CHP, 2 Nos. field programming units for CSP and 2 Nos. field programming units for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling For SP III will be in the scope of Contactor. Apart from standard features, these field programming units will be capable of connection from every Remote I/O station for engineering and troubleshooting purposes.
14. 2 Nos. MIS servers each will be included in the Automation system of CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III.
15. All printers provided with PCs will be laser jet type.
16. The design will be done in such a manner that involvement of cabling and wiring is minimum.
17. All the automation equipment will be configurable to a user configurable fail-safe state to avoid dangerous situations in case of any failures due to power failure, communication failure etc.
18. Different levels of networks will be inter-connected through intelligent devices which are capable of high speed switching at least at Layers 3 & 4 with access control. For all important systems firewall will be provided, taking care at Layers 3 to 7.
19. Temperature monitoring of all remote I/O stations will be provided through respective PLC.

20. Power & Control Supply monitoring of all mechanisms will be provided through PLC.
21. Status of UPS to be monitored through PLC / HMI.
22. All new PLCs supplied in this package, will be interfaced to Main PLC on Ethernet. Apart from main PLC as described in automation configuration drg., other PLCs (if) coming under this package shall interface with main PLC of CHP/CSP/FFP
23. The communication networks will be dully tested & certified by authorized agency.
24. For better co-ordination, the complete automation system will be ordered on one sub-vendor i.e. the OEM of PLC system.
25. Ethernet network (FO and UTP)
 - GTS GS-12 shall be referred for specifications related to ethernet network
 - FO link from CSP IV control room to main control room of COB#11(Battery and CDCP) and from existing SP3 CR1 to main control room of SP 3 machine 2 for exchange of needed information.
 - FO link to be used (Not UTP) if link taken outside building or shop floor.
 - All FOC/UTP carrying conduits/pipes to be paint marked as per standard color code specified by employer

04.11.02 SCOPE OF WORK AND SUPPLY

Contactor's scope of work and supply will include design, engineering, manufacture/ procurement, assembly, calibration, shop testing, inspection at works & at site, painting, packing, transportation to site including loading, unloading, storage & handling of all Automation equipment including electrical accessories, cables, GI pipes, erection accessories, panels/ cabinets and all associated hardware, as required for completeness of Automation system in all respect along with site fabrication, erection, testing, commissioning of the complete automation system and interfacing with different PLCs as described else where in the contract for completeness & satisfactory operation of the entire Coal Handling Plant, Coke Sorting Plant and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III as per technological layout and material flow diagram. The scope of work will also include liquidation of defect points, participation in tests for establishment of plant performance guarantee (PG) and post commissioning activities till issue of final acceptance certificate (FAC) by BSP.

The scope of work and supply will include but not limited to the following:

1. Automation system as per the facilities indicated in the Automation System Configuration diagram (Drg. No: MEC/S/9101/11/E9/55/01/064.01/R1) for CHP & Drg. No: (MEC/S/9101/11/E9/55/01/064.02/R1)for CSP and (Drg. No: MEC/S/9101/11/E9/55/01/064.04/R3)MEC/S/9101/ 11/E9/0/00/00/064.04/R3 for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III and as described in 'General' and 'Salient Features of CHP, CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III'.
 - a. For CSP this will mainly include independent PLC systems with redundancy in: - processors, power supply modules, communication modules, network interface modules, MIS servers etc. for plants/units. Number of operator's station and engineering work station shall be as automation configuration diagram. Communication bus will be ring architecture type. The automation system will be client-server based configuration. All the required facilities & features for interfacing of PLC systems will be considered and provided accordingly.
 - b. For CHP, the Contactor will provide PLC based automation system, with redundancy in:- processors, power supply modules, communication modules etc in line with GTS. Number of operator's station and engineering work station shall be as automation configuration diagram. Remote I/O stations, I/O Level communication Bus, necessary gateway (associated hardware and software) for interfacing with employer Automation network, Engineering station, HMI shall be as shown in Automation Configuration drawing.
 - c. For Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III, the Contactor will mainly provide PLC based automation system, with redundancy in :- processors, power supply modules, communication modules, network interface modules as per GTS. Number of operator's station and engineering work station shall be as automation configuration diagram. Operator's and engineering workstations, Remote I/O stations, I/O Level communication Bus, Control-level bus, necessary gateway (associated hardware and software) for interfacing with employer Automation network, Engineering station, HMI shall be as shown in Automation Configuration drawing.
2. Required nos. of local/remote I/O panels with adequate quantity of various types of I/Os cards, i.e. Digital, Analogue, RTD, Thermocouples, Pulse, power supply cards, communication cards, Relays with NO contacts for outputs etc. at different locations.

Contactor will also consider input interposing relays for field mounted proximity switches in the I/O chassis.

3. Preferred Makes of individual equipment i.e. PLC systems, Workstations, Servers, Engineering stations, printers etc., will be in line with GS-13. All the Hardware in Individual Systems will be from the same product series.
4. All required software i.e. System software, HMI software, Application programmes etc. for PLC, Workstations, Servers, communication interface amongst various automation systems etc. Required number of software licenses will also be provided.
5. All maintenance, diagnostic tools & devices required for implementation, maintenance & trouble shooting.
6. 1 No. field programming unit for CHP, 2 Nos. field programming units for CSP and 2 Nos. field programming units for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III will be in the scope of Contactor. Apart from standard features, these field programming units will be capable of connection from every Remote I/O station for engineering and troubleshooting purposes.
7. All Network components like Gateways / interfacing modules, cables, multi-port switches (if applicable) etc., as required for interfacing.
8. Optical Link Modules, Light Interface Unit, Redundant link modules, Power supply Cards, Converters, Terminators etc. as per requirements.
9. Other than the PLC systems specified in the configuration diagram, if any separate PLC systems are required for operation of the auxiliary units of the proposed CHP, CSP and Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III the same will also be offered and suitably interfaced with the main automation system.
10. All types of system cables, communication cables, LT power cables, special cables, etc., as required. This will also include the required communication interface and cable for interfacing with the PLCs of conveying system of COB#11, Blast Furnace Stock House, Sinter Plant, CDCP etc. (as described in 'Interfacing' in CTS), located at respective control rooms.
11. Necessary co-ordination with employer / Mecon for establishing interfacing and integration requirement by providing new PLC, multiplying relays as required, interconnecting cabling between employer's MCC/ other panels and Contactor's PLC/ Remote I/o stations etc.

12. Fully wired cabinets/ panels, etc with MCBs, Fuses, CFL Lamps, Universal type service sockets, Earth strips, etc.
13. Control room furniture for CSP dispatcher
14. In existing Control Room/Dispatcher –CR1 of Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III, existing 4 monitors will be replaced by new TFT monitor of size 22”, identical to new monitors for aesthetic looks.
15. Submission of drawings and documents as per mentioned at clause no. 06.11.05 of this CS.
16.
 - a) In the automation system for CHP, few facilities from Pkg-062 are proposed to be used. These facilities include Fault-tolerant HMI server, Fault-tolerant history and process support server, Fault-tolerant MIS server, Network at Despatcher-D2, etc. Contactor will be responsible for all necessary activities, including coordination, with the supplier of Pkg-062 towards licensing requirements, development of application for Pkg-064, deployment of clients, network etc.
 - b) Erection, testing, calibration and commissioning of the total Automation equipment / system of CHP, CSP and FFP included in this specification. Required interfacing with employer’s PLCs by providing necessary hardware and software and interconnecting cables. This will also include laying and termination of system bus cables as required.
17. Contactor will arrange tools, tackles and consumables as may be required for erection, testing, calibration and commissioning activities.
18. Contactor will arrange inspection of Automation equipment by Employer/ Consultant. Inspection and Testing will be carried out in compliance with the Quality Assurance Plans and FAT document, to be approved during detailed engineering stage.
19. Contactor will arrange visit by respective Automation manufacturer’s representatives at site, as & when required, during erection & commissioning.
20. Testing tools & equipment for automation system
21. Special tools will be provided in sufficient number for tracing, location, testing, jointing, fault location & rectification, termination etc. for all cables including special cables.

22. Contactor will involve Employer / Mecon in control philosophy development, design of application software and hardware, drawing up of software specifications, software development, off-line testing etc.
23. All tests on software, hardware, network, communication etc. will be carried on the basis of a pre-agreed protocol clearly listing out steps involved in testing with its responsibility and minimum expected results as per specifications, engineering and other documents.
24. Troubleshooting manual for all application software, system software, configuration, hardware, network etc. will be provided clearly spelling out possible causes, checks and measures for corrective action.
25. Contactor will arrange training for Employer's personnel on the automation system at manufacturer's works and also at site.
26. Two years maintenance spares, if the order is separately placed by Employer.
27. Commissioning spares and three months consumables.

04.11.03 SALIENT FEATURES OF CONTROL & AUTOMATION SYSTEM FOR COAL HANDLING PLANT, COKE SORTING PLANT AND AUGMENTATION IN FLUX - FUEL PREPARATION AND PLANT RETURN FINES HANDLING FOR SP III

01. For monitoring, control, interlocking and sequential operation of CHP, CSP and FFP, PLC based automation systems will be provided. Considering information exchange & operational requirement all the systems will be suitably interfaced. All the printers will be provided with network connectivity.
02. In Client server based Automation system, hot redundant servers will be considered. This architecture will have 3 level ring type bus system. The PLC systems will communicate with each other and the servers through a common ring topology bus. All the HMI stations will be interfaced with the servers through a separate higher level bus. Respective PLCs will have independent engineering station. Suitable communication cards will be provided in respective I/O panels for interfacing with HT switch-boards; Intelligent MCCs, Remote I/O station, Weighing Controllers, TR controllers etc.
03. Each Operator Workstations will have 22" Flat dual TFT Monitor as shown in Configuration drawings.
04. The automation system will be powered from UPS of suitable rating. Details of UPS have been separately indicated in this TS and GTS.

05. All the new MCCs of CHP and CSP and MCPs of CHP, CSP and FFP will be of Intelligent Type. i.e. every controller (DOL/RDOL feeder) will have an intelligent relay having capability to communicate directly with PLC Controller. Power supply feeders in MCC need not to communicate with PLC except of those feeders which feed to other Process MCCs & ACB/MCCB incomers.
06. All the HT breakers & LT breakers in PCC will also have communication ability to Automation system.
07. All the weighing controller/Indicator panels, VFD etc. will communicate directly with PLC Controller.
08. Optical link module will be used for converting Electrical bus to Optical bus.
09. Contactor will consider Remote I/O panels at each electrical premises with all kinds of Remote I/Os.
10. Additional Engineering spare Remote I/Os will be carefully planned at each location in such a way that they can be used in the unlikely event of non-establishment of communication with field devices having bus communication.
11. One Remote I/O panel (with required numbers interface modules/types of I/Os) will be planned in each electrical premises, each electrical floor (in case of multi-story rooms) & junction houses / Technological Buildings for interfacing of field switches.
12. All the communication cables will be laid in GI pipes. Separate pipes with separate routes (to the extent possible) will be used for ring topology type communication bus.

GENERAL CONTROL REQUIREMENT

13. All the drives will generally be provided with following modes of operation and control:
 - **Local De-interlock**
 - **Local interlock**
 - **Remote**

Mode of selection will be carried out for all drives with the help of selector switch provided on the MCCs / MCPs and required nos. of wall mounted boards / boxes for HT motors.
14. For local operation of drives, permission from Operator at Despatcher Control room will be obtained which will be named as

automation permission. For this purpose, specific menu will be provided with operator workstation for such drives.

15. Local De-interlock mode of operation will be used only for adjustment, maintenance and testing purpose. After the selector switch at MCC / MCP is selected to Local De-interlock mode and Operator/PLC permission is obtained from Control room, the drives/valves can be started/opened/closed from Local control stations using start/open/close push buttons. Under this mode of operation, all safety interlocks (Pull Chord Switches, motor over load, Emergency switch etc.) will be provided through hardwire in the circuit.

The stop push button provided in Local Control station will stop the drive under all mode of operation. In case of emergency Stop, alarm will be provided at the Operator workstation at control room to warn the operator. Hooter PB will be provided in LCS for pre start warning.

16. Local interlock mode for running the drive in sequence interlocked mode from LCS. Selector switch will be put in local interlocked position and permission from operator / PLC will be pre requisite condition. In this mode start, stop, motor over load, emergency stop, Pull Chord & Belt Sway Switches, Zero Speed Switch, chute jamming switches will be in the circuit through hardwire in addition to interlock with successive conveyor / equipment.
17. Under remote mode of operation, following control modes for all drives will be provided through Operator workstation.
 - i. Remote Manual
 - ii. Automatic

Selection of remote manual or automatic mode of operation will be carried out using command menus through Operator workstations.

Remote Manual mode

Under remote manual mode of operation, individual drives will be started/stopped from Operator workstation. However, necessary safety interlocks will be provided by automation system. This mode can be used for testing of individual drives from Control room.

Automatic mode

Under Automatic mode, the plant/equipment will be controlled, started/stopped automatically in sequence by automation system using various command menus from any of the Operator workstations.

04.11.04 CONTROL ROOM / DESPATCHER ROOMS

A. COAL HANDLING PLANT:-

Route wise operation of offered CHP (under Pkg-064) of the Contactor and Coal transportation system (under Pkg-062) of the employer will be operated from a common dispatcher D2. The Dispatcher D2 building is located near COB#11 and is in Employer's scope covered under Package 062. The Contactor will supply PLC, Engineering Station, Work Station, Emergency Work Station etc. as per Automation Configuration Drawing (**No.- MEC/S/9101/11/E9/0/00/00/064.01/R1**) of CHP. The Contactor will furnish assignment drawing and space requirement to the employer to keep the provision in the Dispatcher-D2.

B. COKE SORTING PLANT:-

One no. Dispatcher will be provided by the Contactor for control of transportation of coke from JH-1 to various destination as per Material Flow Diagram & Technological layout. Dispatcher will be a new building near Coke Screening Station under Contactor's scope. Civil, Structural, floor & Ceiling requirements for the Dispatcher / Control Building are described elsewhere in the TS.

- C. New PLC with RIO's will be provided for Augmentation in Flux - Fuel Preparation and Plant Return Fines Handling for SP III which will be connected to existing PLC through suitable gateway. The new PLC & HMIs will be housed in existing Control Room 1(CR-1). The existing HMIs will suitably be upgraded to match the new HMIs for operation of the entire existing and new Flux & Fuel Crushing & Screening plant.

D. COMMON POINTS:-

01.The Dispatcher / Control Buildings will be air-conditioned and provided with false ceiling & false flooring. The respective rooms will have following suitable aluminum framed glass partitions as listed below:

- a. At one partition called as **operator room** will house the operator workstations, printers and other peripherals of the automation system along with Control desk (for work stations/printers) & operator chairs.
- b. A separate partition in the control room / Dispatchers will be used for installation of Engineering Stations, Servers (if applicable) & Software/Hard-ware related documentation.
- c. A separate partition will be used for installation of PLC Panels, I/O panels, Instrumentation panels, Weighing panels, & all other electronic panels as per the detail engineering.

02.All the above partitions will be accessible **directly** from a common walkway.

03. Control room and Despatcher will also have facility of Toilet block. Central control room will have one conference room (with Table & Chairs for 12 persons) & Pantry. However Contactor may accommodate some of these facilities on floor below Control room also, during detail engineering.
04. Control desk (for installation of HMIs & Engineering Stations etc) will be of most modern & aesthetic design with Cable Management system.

04.11.05 LIST OF DRAWINGS & DOCUMENTS

Following drawings and documents will be submitted by the Contactor:

A. TO BE SUBMITTED BY THE CONTACTOR DURING DETAILED ENGINEERING

I) FOR APPROVAL:

01. Finalised system configuration diagram for the automation system along with its peripherals with list of hardware and write-up on the system.
02. Bill of Materials & Data Sheets of all the hardwares i.e. Processors, Communication modules, Power supply cards, RLM, OLM, Operator stations, Eng Stations, Servers, Bus cables etc.
03. Overall General arrangement drawings & sectional views of various cabinets, panels, consoles, etc., showing internal disposition of all components/ units, with dimensional details and bill of materials.
04. Interconnecting diagram between existing MCCs & other panels of employer and PLC / Remote I/O stations of the Contactor.
05. Single line power supply diagram with specification and bill of quantities of electrical accessories.
06. Quality assurance plan & Factory Acceptance Test procedures for Automation system.
07. Control room layout drawing showing disposition of panels, consoles, desks, etc with dimensional details.

II) FOR SCRUTINY AND REFERENCE

01. Detailed technical literature/ catalogue for Automation system with peripherals, highlighting the model number.

02. Input/ Output list.
03. Terminal diagram of all the RI/O & Marshalling panels.
04. Cable schedule and specification.
05. System grounding scheme.
06. Formats and work sheets for generation and display of overview, groups, loops, graphics, alarms, operator's guide messages, real time & historical trends, log & shift formats.
07. Detailed listing of application software, system software, HMI software, etc and the number of licenses.
08. Application software formats and details in documentation and CDs.
09. Manufacturer's test, calibration and guarantee certificates for all instruments and automation system.
10. Operation and maintenance manuals for Automation system.

III **As-built drawings and documents.**

1. Drawings and documents of complete automation systems
2. Soft copy of all the above drawings & documents in CDs/DVDs.

DATA SHEETS

01.00 TECHNICAL DATA SHEET (To be filled by the vendor)

A. Air compressors

- | | | | | |
|-----|---|---|---------------------|--------------------|
| 01. | Manufacturer's Name & address | : | | |
| | Model No. | : | | |
| | Type | : | | |
| | No. provided | : | | |
| | Rated capacity Nm ³ /min | : | | |
| | Rated discharge pressure, kgf/cm ² g | : | | |
| | kW input at motor terminal | : | | |
| | Motor rating | : | | |
| | Air temp. at delivery after after-cooler at rated capacity and pressure, deg.C. | : | | |
| | Screw Speed, rpm | : | | |
| | 1st stage (male & female) | : | | |
| | 2nd stage (male & female) | : | | |
| | Oil content in the air at outlet of air compressor, ppm. | : | | |
| | Noise level at source when the compressor running at rated capacity, dB (A). | : | | |
| | Cooling water requirement | : | | |
| | Pressure drop across compressor | : | | |
| | Temp. rise | : | | |
| 02. | Inter cooler & after cooler | | <u>Inter cooler</u> | <u>Aftercooler</u> |
| | No. per compressor | : | | |
| | Design standard/code | : | | |
| | Make | : | | |
| | Max. working pressure, kgf/cm ² g | : | | |
| | i) Water side | : | | |
| | ii) Air side | : | | |
| | Tube material, size and thickness | : | | |
| | Shell material and thickness, mm | : | | |
| | Moisture content in air after aftercooler, ppm | : | | |

Space required for pulling out :
tube assembly of intercooler
& aftercooler

03. Moisture separator

Make :
Type :
Model :
Number :
Design standard/code for :
pressure vessel
Shell material and thickness :
Design pressure,kgf/cm² (g) :
Moisture content after separator :

B. Motor

Type :
Make :
Rated kW at 50 deg.C :
Rated kW at 40 deg.C :
Rated voltage & system condition :
Frame size. :
Class of insulation :
Rated speed & direction of rotation :
Starting system :

C. Refrigerant type Air Dryer

Make :
Model :
Capacity :

D. Air Receiver

Number :
Design Standard/ Code :

Capacity	:
Overall dimensions	:
Wall plate thickness	:
Plate material	.
Design Pressure	:
Working Pressure	:

E. COOLING TOWER FOR COMPRESSOR COOLING

Make & Model	:
Type	:
Quantity	:
Overall size of cooling tower	:
Capacity of cooling in TR.	:
Water flow m ³ /h	:
Air flow	:
Design water inlet temperature, outlet temperature	:
Material of construction and its thickness	:
Speed in rpm	:
Drive details	:
Shaft Power consumption	:
Wheel diameter	:
Efficiency	:
Size of fan	:
Static & Dynamic weight of fan & motor assembly	:
Bare weight and operating weight of cooling tower	:
Noise level at 1m distance in dB(A)	:
Fixing details	:
Vibration level	:
Water spray nozzle type	: